THE

# GARDENS' BULLETIN

STRAITS SETTLEMENTS

Vol. VIII 28th October, 1935 Part 4

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THE
# GARDENS' BULLETIN
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## NOTES ON MALAYAN DIPTEROCARPACEÆ—III

*By* C. F. SYMINGTON

These notes are a third contribution to the systematic study of the *Dipterocarpaceae* of the Malayan region.*

Nine species of *Shorea* and three of *Hopea* are included in this paper—the controlling factors in their selection being the urgency of the problem involved, the quality and quantity of material available, and an endeavour to follow as systematic a sequence as possible. Commencing with *Shorea guiso* (a species requiring considerable study), I have discussed three other related species—*S. collina, S. ochrophloia,* and *S. Foxworthyi.* Next I have given my arguments supporting the change in botanical name of a tree, hitherto known in the Malay Peninsula as *Hopea dealbata,* to *H. Helferi. H. apiculata* (a recently discovered species) has then been described and figured in some detail because of its botanical interest, and along with it is included *H. resinosa,* the only other representative of the *Pierrea* group known from the Malay Peninsula. *Shorea bentongensis,* the first member of the section *Anthoshorea* on which I have had occasion to publish notes, must stand alone in this paper as my manuscript on related species is not yet complete.

From Borneo, thanks to the efforts of the Forest Officers in British North Borneo, Sarawak, and Brunei, a large amount of excellent herbarium material of dipterocarps has accumulated since 1932. Much of this material is representative of undescribed, or little-known, species which require study and classification. A beginning is made in this paper with the descriptions of the new species *Shorea inaequilateralis, S. albida, S. ochracea,* and *S. scabrida.*

In this number, as in number 2 of this series, the citation of literature is more complete than in my first paper, because it seems desirable to record all the literature consulted, whether it be essential to the argument or not.

* For previous papers *see Gdns. Bull. S.S.,* Vol. VII, pp. 129–159 (1933), and Vol. VIII, pp. 1–40 (1934).

The concluding paragraph of the notes on each species is addressed, in particular, to forest officers.

I have, once more, to express my appreciation of the assistance willingly accorded by numerous institutions, botanists, and forest officers. In addition to those mentioned in the introduction to my last paper in this series I am particularly grateful to the Conservator of Forests, British North Borneo and the Conservator of Forests, Sarawak, for the loan of their entire collections of *Dipterocarpaceae.*

**Shorea guiso** (Blanco) Bl., Mus. Bot. Lugd.-Bat. 2: 34 (1852); Vidal, Sinopsis Atlas 15, tab. 15, f.C (1883); Brandis in Journ. Linn. Soc. 31: 89 (1895); Perk., Frag. Fl. Philip. 23 (1904); Merr. in Philip. Journ. Sci. 1, Suppl: 98 (1906), Spp. Blanco.: 270 (1918), et Enum. Philip. Fl. Pl. 3: 97 (1923); Foxw. in Philip. Journ. Sci. (Bot.) 2: 384 (1907), 4: 509 (1909), 6: 272 (1911), & 13: 191 (1918), et Mal. For. Rec. 10: 175 (1932) in obs.; Whitford in Philip. Bur. Forest. Bull. 10: 71, tab. 74 & 75 (1911); V. Sl. ex Merr., Univ. Calif. Pub. Bot. 15 (Pl. Elmer. Born.): 203 (1929); Desch in Mal. Forester 4: 29 (1935), in nota: *Mocanera guiso* Blanco, Fl. Filip. 449 (1837): *Euphoria malaanonan* Blanco, l.c. 286, non *Shorea melaanonan* Bl: *Dipterocarpus guiso* Blanco, op. cit. ed. 2: 313 (1845), et ed. 3, 2: 215 (1878): *"Euphoria* vel *Nephelium"* Blanco, op. cit. ed. 2: 200 (1845), et ed. 3, 2: 9 (1878): *Anisoptera guiso* A. DC., Prodr. 16, 2: 616 (1868): *Shorea robusta* F.-Vill., Novis. App. 21 (1880) non Gærtn.: *Shorea vulgaris* Lanessan, Pl. Utiles Col. Fr. 301 (1886); Pierre, Fl. For. Cochinch. Fasc. 15, tab. 232 (1890); Brandis in l.c. 81, tab. 2, 15 & 16 (1895); Guérin ex Lecomte Fl. Gén. Indo-chine 1: 380 (1910): *Shorea Vidaliana* Brandis in l.c. 83 (1895): *Shorea Warburghii* Perk. l.c. 23 (1904) non Gilg.: *Shorea scrobiculata* Foxw. in Philip. Journ. Sci. Bot. 13: 192 (1918) non Burck: *Shorea longipetala* Foxw., Mal. For. Rec. 10: 174, tab. 13 (1932); Sym. apud Desch in l.c. 28 & 29 (1935). Plate XVI.

Foxworthy has described this species under the name of *S. longipetala* but the following additional information may be helpful:—the *leaves* vary in size and shape through a much wider range than that described; there may be as many as 26 pairs of *main nerves;* the *petioles* are normally over 1.0 cm. long; the *flowers* may be almost sessile; the *stamens* vary in number (in the flowers I have examined) from 20 to 41; and the cilia on the appendages from 1 to

**Shorea guiso** (Blco.) Bl.

8. The *fruits*, of which I have seen only one really mature collection (C.F. 9508), may be described as follows:—stalk 1.5 mm. long, stellate-puberulous; calyx lobes swollen and woody at the base, closely appressed to one another, enclosing rather less than half of the nut, puberulous; three large wings linear-spathulate, 6.0–7.0 cm. × 0.9–1.2 cm., about 8–nerved; two small wings linear, about 3.5 cm. × 0.2 cm., 3 to 5–nerved; nut about 1.3 cm. × 0.8 cm., sericeous-tawny tomentose, terminated by a tomentose beak which is 4.0 mm. long.

This species was first described by Blanco from Philippine material in 1837 under the name of *Mocanera guiso*. This name he altered to *Dipterocarpus guiso* in subsequent editions of his "Flora de Filipinas". Under the names *Euphoria malaanonan* and "*Euphoria* or *Nephelium*" Blanco described sterile, galled collections of the same plant. Fernandez-Villar (1880) considered this to be *Shorea robusta* Gærtn.—an error rectified by Merrill in 1918 when he established the true identity of *Euphoria malaanonan* in his "Species Blancoanæ".

The combination *Shorea guiso* was first made by Blume in 1852. In 1868 De Candolle placed the species in *Anisoptera*, but, in 1895, Brandis again reverted to *Shorea*, to which genus it obviously belongs.

In 1886 this species was discovered in lower Cochinchina and named *Shorea vulgaris* by Lanessan. Pierre described and figured the species in some detail in his Forest Flora of Cochinchina in 1890. His descriptions and figure are slightly inaccurate in some respects (notably in the large number of hairs on the appendage) but examination of the Kew sheets of Pierre's type specimen (1727) convince me that it is conspecific with *Shorea guiso*.

Later Philippine collections were described as *Shorea Vidaliana* by Brandis in 1895, and referred to *Shorea Warburghii* Gilg. by Perkins in 1904. I have not had the opportunity of examining these collections, but I have included them in my synonymy on the authority of Merrill and other Philippine botanists. Another Philippine collection (22712) was referred to *Shorea scrobiculata* Burck by Foxworthy in 1918. I am in agreement with Merrill who has identified it with *Shorea guiso*.

Our collections from the Peninsula date from 1918 and were described by Foxworthy in 1932 as *Shorea longipetala*. At the time Foxworthy was aware of the close affinity of *S. longipetala* and *S. guiso*, and suggested that reduction might be necessary. *Shorea guiso* was collected

in British North Borneo by Elmer in 1923 (*vide* V. Sl. ex Merr., *Pl. Elmer. Born.*) and in Peninsular Siam by Foxworthy in 1930. The latter collections are here recorded for the first time.

Collections examined:—

COCHINCHINA: Pierre 1727 (Auth. spec. of *Shorea vulgaris* Lanessan).

SIAM: S'pore 24236 & 27239.

MALAY PENINSULA:

KEDAH: C.F. 17788, 27379, & 27400.

KELANTAN: C.F. 32723, 32731, 32732, 32830, 33263, 33264, 33406, & 33452.

PERAK: C.F. 0132, 0138, 8334, 10258, 10354, 10424, 11596, 16703, 25443, 25747, 29018, 29019, 29875, 30741, & 30802.

DINDINGS: C.F. 16802 & 27843.

TRENGGANU: C.F. 26929 & 26933.

PAHANG: C.F. 1277, 4503 (Auth. spec. of *Shorea longipetala* Foxw.), 4856, 5447, 7932, 9508, 13797, 15627, 17242, 17334, 23361, 26033, 26035, 27994, 28324, 29378, 29961, & 37316.

SELANGOR: C.F. 12065, 23086, 23329, 24203, 24245, 25168, 33556, & 33895.

NEGRI SEMBILAN: C.F. 12837, 12849, 18199, 20135, 24304, & 26614.

MALACCA: C.F. 25286.

BRITISH NORTH BORNEO: C.F. 38836 (S.H. No. 4460).

PHILIPPINES: Bur. Sc. Philip. 2865, 7344 & other colls. at Kew, 11773, 27136, 27373, & 29063. Merr. Spp. Blanco. no. 407.

The tree, for which the preferred name of *membatu* is given in our list of Botanical Equivalents, was described as *Shorea longipetala* in 1932. This species is here shown to be the same as *Shorea guiso* of the Philippines and *Shorea vulgaris* of Cochinchina. The oldest name *Shorea guiso* must, in future, be adopted for our species, which, it is interesting to note, extends from Cochinchina through Siam, the Malay Peninsula, and Borneo, to the Philippines.

**Shorea ochrophloia** E. J. Strugnell (Ms.) **sp. nov.**; Sym., apud Desch in Mal. Forester 4: 28, nomen. Plate XVII.

Ab affine S. guiso (Blco.) Bl., ramulis crassioribus, foliis tomentosis crassioribus, paniculis densioribus facile distinguenda.

*Branchlets* densely fulvous stellate-tomentose when young; later glabrescent, black. *Leaves* ovate, elliptic-ovate,

**Shorea ochrophloia E. J. S. ex Sym.**

to ovate-oblong, usually shortly blunt-or mucronate-acuminate at the apex, rounded or subcordate at the base, margins subrevolute, average size about 7.0 cm. × 5.0 cm. but very variable, glabrous (except on midrib) and usually drying yellow- or red-brown above, fulvous tomentose on the nerves beneath; midrib slightly depressed and tomentose above, strongly elevate and stellate-tomentose beneath; main nerves 13 to 17 pairs, slightly depressed above, strongly elevate and stellate-hairy beneath; nervules joining the main nerves in parallel curved lines, inconspicuous above, conspicuous and stellate-hairy beneath; petioles terete, thicker in the upper portion, 0.8–2.0 cm. long, fulvous tomentose; stipules oblong-obtuse, subfalcate, 6.0 mm. × 3.0 mm., tomentose on both surfaces, caducous. *Panicles* axillary and terminal, lax; main axis usually less than 5.0 cm. long, fulvous tomentose; ultimate branchlets about 5.0 mm. apart, 1.0–2.0 cm. long, grey tomentose, each bearing 2 to 6 secund flowers. *Flowers* 2.0–3.0 mm. apart, elongate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0 mm. long, grey tomentose. *Sepals* ovate-obtuse, subequal, densely tomentose outside, glabrous inside. *Petals* linear, pale-sericeous tomentose outside, "creamy-white with a purple-red patch inside at the base" (Symington, C.F. 30735), falling separately. *Stamens* 26 to 30 (in flowers examined), of three heights, arranged in 3's (*vide* plate XVII, 15 & 16); anthers elliptic-oblong, posterior cells slightly smaller than the anterior; filaments 2 to 4 times as long as anthers, broad at the base, narrow in the upper half; appendage to connective less than half the length of the anther, blunt, becoming reflexed, with 3 to 5 (usually 3) fine hairs. *Ovary* ovate, narrowed above, densely sericeous tomentose; style short, cylindric, glabrous; stigma not enlarged. *Fruit*—a 5-winged nut: stalk 2.0 mm. long, stellate-puberulous; bases of accrescent calyx wings thickened and woody, enclosing one half of the nut, stellate-puberulous; three outer wings linear-spathulate, narrowed to the base, 5.0–7.0 cm. long × 1.3–1.5 cm. broad, 7 to 8-nerved, puberulous in the lower portions, red-brown; two inner wings smaller, linear, about 4.0 cm. × 0.5 cm., 5 to 6-nerved; nut ovate, rostellate, about 1.5 cm. × .7 cm., pale tomentose; rostellum up to 5.0 mm. long, densely tomentose.

*Shorea ochrophloia* is a typical member of the section *Eushorea*. In flower characters it is almost indistinguishable from *Shorea guiso* (Blco.) Bl. (*vide* p. 266), but the coarser and hairer leaf is a simple diagnostic character.

The epithet *ochrophloia*, given in manuscript by Mr. E. J. Strugnell, is descriptive of the yellow-brown colour characteristic of the bole of this tree.

Collections examined:—

MALAY PENINSULA:

KEDAH: C.F. 27482 (TYPE of flower of *S. ochrophloia* E.J.S.).

KELANTAN: C.F. 33356.

PERAK: C.F. 25634, 27250, 29016 (TYPE of fruit of *S. ochrophloia* E.J.S.) 29017, 29020, 30735, & 30923.

TRENGGANU: C.F. 26882.

PAHANG: C.F. 10628, 26032, 26048, 26219, 27884, & 29962.

SELANGOR: C.F. 22964 & s.n. (Mitchell, 1st. Aug., 1918).

NEGRI SEMBILAN: C.F. 12838, 20851, & 32690.

*Shorea ochrophloia* is a little-known species that is here described for the first time. It appears in our list of Botanical Equivalents under the vernacular name of *seraya batu*. The tree appears to have a wide distribution on low hills throughout the Peninsula but it is not known to be common anywhere. The timber is placed by Mr. Desch (Mal. Forester 4: 28) in the *damar laut merah* grade.

**Shorea collina** Ridl. in Agri. Bull. S.S. & F.M.S. 9: 182 (1910), et Fl. Mal. Penins. 1: 231 (1922); Burn-Murdoch, Trees and Timbers Mal. Penins. 1: 13, tab. (1911); Heyne, Nutt. Pl. Ned. Ind. 3: 299 (1917), 2nd edit. 3: 1116 (1926); Foxw., Mal. For. Rec. 3: 63 (1927) partim, et Mal. For. Rec. 10: 173 (1932) partim; non Sym. apud Desch in Mal. Forester 3: 195 (1934): *Shorea angustiloba* Foxw., Mal. For. Rec. 10: 168, tab. XI (1932); Sym. in l.c. (1934), et l.c. 4: 26 (1935). Plate XVIII.

*Branchlets* flattened when young, dark purple to black, usually with a few minute stellate hairs; later terete, black. *Leaves* broadly elliptic or ovate to elliptic-oblong, shortly blunt-acuminate at the apex, rounded to subcordate (sometimes subequal) at the base, usually about 7.0 cm. ×13.0 cm. but varying between wide limits, glabrous (except for the midrib) and usually drying dull grey above, glabrous and usually red- or purple-brown beneath; midrib slightly sunk and fugaceous-tomentose above, strongly elevate striate glabrescent beneath; main nerves about 12 pairs, strongly elevate on the lower surface, inconspicuous above; nervules joining the main nerves in fine parallel lines, with fine reticulations between them, distinct beneath, less conspicuous above; petioles thick, rugose, slightly swollen in

**Shorea collina Ridl.**

the upper portion, 2.0–3.0 cm. long, black, glabrescent; stipules caducous (not seen). *Panicles* axillary and terminal, main branches thin, 2.0–4.0 cm. long, puberulous, black; lateral branchlets less than 1.0 cm. long, puberulous, each bearing 1 to 3 flowers. *Flowers* about 2.0–3.0 cm. apart, about 8.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, rugose, tomentose. *Sepals* rotundate, apiculate, two slightly smaller than the other three, tomentose outside, glabrous inside. *Petals* oblong to linear-oblong, broader at the base, pubescent outside, glabrous inside. *Stamens* 55 (one flower only examined), of several sizes—the inner row twice as high as the outer; anthers oblong, posterior cells smaller than the anterior; filaments one to four times as long as the anthers, broad and subgibbous below (particularly the inner row), suddenly narrowing to the filamentous upper portion; appendage to connective about one half the length of the anther, slightly reflexed, with 2 to 5 bristles. *Ovary* ovate, densely setose; style short, cylindric, glabrous; stigma minute, slightly 3-notched. *Fruit*—a nut with 5 rudimentary wings; stalk 3.0–5.0 mm. long, stellate-puberulous; bases of calyx lobes thickened, woody, pale fagaceous-tomentose, red-brown beneath, enclosing half of the nut; three large outer wings irregular in size, linear-oblong, up to 4.0 cm. × 1.0 cm. but usually smaller, puberulous, red-brown, about 7-nerved; two inner wings linear, 1.5 cm. or less ×3.0–4.0 mm., about 4-nerved; nut ovate-orbicular, rostellate, 2.5–4.0 cm. × 2.0–3.0 cm., pale tomentose; rostellum up to 7.0 mm. long.

*Shorea collina* was first described by Ridley from a fragmentary flowering specimen (319) collected in 1910 by A. E. Sanger-Davies in Rompin, Pahang, under the vernacular name of *balau bukit*. In 1927 and 1932 Foxworthy added notes under the heading of *S. collina*, but the additional collections, upon which his information was based, belonged to a closely related, but different, species which I am naming *Shorea Foxworthyi*. This latter species has, for some years been considered to be *S. collina* by members of the Forest Department and has been wrongly so named by me in l.c. Collections of the real *S. collina*, made subsequent to 1910, were not recognised as such, but were redescribed under the name of *Shorea angustiloba* Foxw. in 1932. Critical study of the one complete flower remaining upon our type sheet of *S. collina*, and comparison with a recently acquired collection of flowers of the species confused with it, have enabled me to correct this error. Unfortunately the type sheet, which is the only known collection of flowers, is too fragmentary to give a very good idea of the inflorescence.

*S. collina*, which clearly belongs to the section *Eushorea*, is remarkable in the number of stamens, the shape of the filaments, and the large, short-winged nut. The flower structure is very similar to that of a species erroneously considered by Philippine botanists to be *Shorea balangeran* (Korth) Dyer *ex* Vidal (*vide* p. 273). These species (*S. collina* and *S. balangeran* Auct. non Dyer) are, however, readily distinguishable on vegetative and fruiting characters.

Collections examined:—

MALAY PENINSULA:

TRENGGANU: C.F. 26700, 26730, & 26909.

PAHANG: C.F. 319 (Type of *S. collina* Ridl.), 6672, 8103, 8117, 8171, 8184, 8186, 9509 (Type of *S. angustiloba* Foxw.), 17351, 27888, 27940, & 29336.

This is the tree known as *balau merah* in Pahang East. It was described as *Shorea angustiloba* in Mal. For. Rec. 10 owing to misinterpretation of the collection described by Ridley in 1910 as *Shorea collina*. *S. angustiloba* now lapses into synonymy and our *balau merah* becomes *Shorea collina* (*c.f.* notes on *Shorea Foxworthyi*, p. 274).

**Shorea Foxworthyi** Symington **sp. nov.** *Shorea collina* Foxw., Mal. For. Rec. 3: 63 (1927), et Mal. For. Rec. 10: 173 (1932) (excl. 319), non. Ridl. in Agri. Bull. S.S. & F.M.S. 9: 183 (1910); Sym., apud Desch in Mal. Forester 3: 195 (1934) non Ridl. Plate XIX.

*Shorea collinae* Ridl. affinis, sed filamentis ciliatis, ciliis appendiculorum numerosioribus, stylo longiore, nuce parviore, segmentis calycis fructiferi longioribus differt.

*Branchlets* slightly flattened when young, grooved, minutely dense fulvous tomentose; later glabrescent, black. *Leaves* elliptic, elliptic-oblong, ovate-lanceolate, or subovate, acuminate and blunt or mucronate at the apex, rounded to subcordate at the base, usually about 11.0 cm. ×5.0 cm., glabrous and normally drying chocolate-brown above, apparently glabrous (except on the midrib and main nerves) but actually minutely lepidote and yellow-brown or red-brown beneath; midrib slightly sunk above, strongly elevate, striate, puberulous beneath; main nerves usually 11 to 14 pairs, strongly elevate on the lower surface, not raised and comparatively inconspicuous above; nervules joining the main nerves in numerous wavy lines, fine (but conspicuous) beneath, less conspicuous above; petioles grooved, thicker in the upper portion, of similar texture to the young branchlets; stipules oblong, subfalcate, rounded at the apex, 15.0 mm. × 3.0 mm., sericeous inside, coarsely fulvous

Shorea Foxworthyi Sym.

stellate-tomentose outside, caducous. *Panicles* axillary and terminal; main axis stout, grooved, up to 5.0 cm. long, fulvous tomentose; lateral branchlets 4.0 mm. apart, regularly alternating, less than 1.0 cm. long, tomentose, each bearing 1 to 3 secund flowers. *Flowers* about 3.0 mm. apart, ovate-lanceolate in bud, about 1.0 cm. long (including the pedicel); pedicel about 1.0 mm. long, grey tomentose. *Sepals* ovate, obtuse, two slightly smaller than the other three, grey tomentose outside, glabrous inside. *Petals* linear-oblong, slightly contorted in bud, pubescent outside, glabrescent inside, yellow (M. L. Webber, C.F. 30301). *Stamens* 33 to 41 (in flowers examined), arrangement somewhat obscure; anthers oblong, posterior cells smaller than the anterior; filaments as long as to twice the length of the anthers, broad at the base, slightly broader and setose about the middle, narrow at the apex; appendage to connective oblong, about half as long as the anthers, with 7 to 12 unequal bristles. *Ovary* hemispherical, narrowed above, densely setose; style as long as the ovary, cylindric, glabrous, stigma slightly enlarged, obscurely 3-notched. *Fruit*—a 5-winged nut: stalk about 1.0 mm. long, sparsely stellate-hairy; bases of the calyx lobes thickened and woody, enclosing less than half of the nut, sparsely stellate-hairy; three outer wings large, oblong-spathulate, narrowed at the base, 9.0–14.0 cm. × 2.0–3.0 cm., glabrescent, shining red-brown, 9 to 11-nerved; two inner wings smaller, linear, usually about 5.0 cm. × 0.6 cm. but very variable, about 3 to 6-nerved; nut ovoid, rostellate, about 2.2 cm. × 1.7 cm., pale tomentose; rostellum up to 4.0 mm. long.

The first collection of this species (C.F. 9507) was made by F. W. Foxworthy in Baloh Reserve, Kuantan, in 1923. This, along with subsequent collections of the species, was identified by him with Ridley's *Shorea collina*, and in 1932 he described the fruits of 9507 as the fruits of *S. collina*. This error has been repeated in Mal. Forester 3: 193 and other Forest Department publications.

I am now renaming the species *Shorea Foxworthyi*. It is very closely related to *S. collina* Ridl., but the flowers differ in the ciliate filaments, the more numerous cilia on the appendages, and the longer style. The fruits, of course, although essentially similar, differ very markedly in size and in the nature of the calyx wings.

From the Philippines I have seen three sheets (For. Bur. No. 27099, 27381*, & 31057) that are remarkably similar to *S. Foxworthyi* in vegetative characters. Floral

* 27099 & 27381 are cited in Merr. *Enum. Philip. Pl.* 3: 96 (1923) as *Shorea balangeran* (Korth.) Dyer *ex* Vidal, but it is very evident that they are not that species.

dissection of 27099, however, shows that the species is quite distinct, although clearly a member of the same group.

Collections examined:—

MALAY PENINSULA:

PERAK: C.F. 4570, 5386, 8839, 14376, 24492, 24613, 24614, 24616, 24631, 24637, 24646, 24822, 25416, 28063, 28804 (Type of fruit of *S. Foxworthyi* Sym.), 29041, 29704, 30301 (Type of flower of *S. Foxworthyi* Sym.) 30677, 30814, 30895, 31041, 31044, 31084, 32176, 33901, 33902, 33903, 33904, 33905, 33906, & 41560.

TRENGGANU: C.F. 26685, 26712, 26731, 26736, & 26911.

PAHANG: C.F. 1683, 6828, 9507 (Type of fruit of *S. collina* Foxw. non Ridl.), 14902, 17221, 17222, 28801, & 29664.

JOHORE: C.F. 12059.

This is the species for which the preferred name in the Federated Malay States is *balau bukit*. For some years it has been known to Malayan forest officers as *Shorea collina*. It is here shown that this is an error resulting from the misapplication of the name *Shorea collina*, which rightly belongs to our *balau merah*—a species redescribed in *Mal. For. Rec.* 10 as *Shorea angustiloba*.

**Hopea Helferi** (Dyer) Brandis in Journ. Linn. Soc. 31: 62 (1895) tab. 2, 1 & 2, et Ind. Trees 67 (1911); Fischer in Kew Bull. 1927: 206; Sym. in Gdns. Bull. S.S. 8: 22 (1934), in obs.: *Vatica Helferi* Dyer in Hook. f. Fl. Brit. Ind. 1: 302 (1874); *Shorea Helferi* Kurz, For. Fl. Brit. Burma 1: 119 (1877); *Hopea dealbata* Hance in (London) Journ. Bot. 15: 329 (1877); Lanessan, Pl. Utiles, Col. Franc. 300 (1886); Pierre, Fl. For. Cochinch. fasc. 16, tab. 246 (1890); Heim, Recherch. Diptéroc. 61 (1892), in obs.; Brandis in Journ. Linn. Soc. 31: 62 (1895); Guérin ex Lecomte, Fl. Gén. Indo-Chine 1: 374 (1910) icon. 36; Lecomte, Bois l'Indo-Chine 110 (1926) tab. 32; Foxw., Mal. For. Rec. 10: 128 (1932). Plate XX.

Published botanical descriptions and figures of this species, being based on inadequate material, are not very satisfactory. I have therefore prepared the following:—

*Branchlets* dark purple-black, pale fugaceous-tomentose towards the ends. *Leaves* oblong or elliptic-oblong, apex blunt, acute, or subacuminate (but frequently damaged), base equal to markedly unequal and cuneate to cordate, usually about 16.0 cm. × 6.0 cm. but varying between wide

**Hopea**

~~Stravoui~~ **Helferi (Dyer) Brandis**

limits, coriaceous, yellow- or light red-brown, glabrous above, pale yellow or silvery (densely minutely lepidote) beneath; midrib slightly depressed above, strongly elevate striate fugaceous-tomentose beneath; main nerves about 13 to 17 pairs, usually inconspicuous above, elevate beneath; nervules joining the main nerves in numerous, more or less parallel, lines, conspicuous only on the lower surface; reticulations minute; petioles 0.5–1.3 cm., thick, rugose, channeled above, black, glabrous when old; stipules linear, caducous (seen only on immature specimens). *Panicles* axillary and terminal, racemose, when mature about as long as the leaves, pale tomentose; ultimate branchlets about 7.0 mm. apart, 1.0–3.0 cm. long, each bearing 4 to 12 secund flowers; bractioles small, caducous. *Flowers* about 2.0 mm. apart, subovate in bud, about 5.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, sericeous tomentose. *Sepals* imbricate; two oblong-obtuse, thick, tomentose (except on the posterior basal portion); three ovate-acute or acuminate, thinner, tomentose outside only. *Petals* contorted in bud, elliptic-oblong, fimbriate at the apex, tomentose outside on the portion exposed in bud, pale yellow (Parkinson, 5199). *Stamens* 15, three appressed to each petal; anthers ovate-oblong, posterior cells slightly smaller than the anterior; filaments 1 to 2 times as long as anthers, broad and overlapping at the base, filamentous above; appendage to connective filiform, about one and a half times as long as the anther. *Ovary* broadly cylindrical-truncate, constricted in the middle, glabrous, the upper (stylopodial) portion sometimes subpapillose; style about one quarter the length of the ovary, cylindrical; stigma minute. *Fruit:* stalk 1.5 mm. long, pale tomentose; calyx lobes appressed at the base to the lower third of the nutlet; two large lobes linear-spathulate blunt, about 5.5 cm. × 1.0 cm. to 8.0 cm. × 2.0 cm., shining light brown, puberulous at the base, about 9-nerved; three small lobes ovate-acute, about 4.0 mm. × 3.0 mm., puberulous outside, less than one half the length of mature nut; nut ovate, apiculate, about 8.0 mm. × 6.0 mm., striate, glabrous, shining. *Embryo* as in *Hopea sangal* Korth.*

This species was first described by Dyer in 1874, from a collection (No. 716) made by Helfer at Mergui in Tenasserim. The type collection, of which I have seen the

* The normal embryo of *H. Helferi* is almost indistinguishable from that of *H. sangal*, but I have not noted any instance of multiple ovule development—a common feature of *H. sangal*. I might note here that, just before germination, the nutlets of this group become slightly inæquilateral, owing to the irregularly exerted pressure of the swelling embryo which finally ruptures the pericarp in an indeterminate fashion. This is a very different mode of germination from that of the *Pierrea* group (*vide Gdns. Bull. S.S.* 8: 32).

Kew and Calcutta sheets, bears flowers and has leaves with cordate, unequal bases. The systematic position of the plant seems to have puzzled several authors. Dyer originally referred it to *Vatica* in 1874, Kurz removed it to *Shorea* in 1877, while Brandis placed it in its present genus, *Hopea*, in 1895.

In 1877, Hance described a fruiting collection, of what he thought to be a new species from Cambodia, as *Hopea dealbata*. He cited no specimen, but Pierre, enlarging upon Lanessan's description in 1890, cited No. 1457, a sheet of which is at Kew. Although this sheet bears fruits only, and has truncate to subcuneate leaves, I am uniting it with *Hopea Helferi** without hesitation. A number of collections of the species, mainly from Burma and the Malay Peninsula, has accumulated of recent years. Some of these are an excellent match for *H. Helferi* and some for *H. dealbata*, while others are representative of gradations between the two. In examining this herbarium material one cannot but be impressed by the superiority of leaf texture over leaf shape as a diagnostic character.

Pierre, Heim, Brandis, and Foxworthy all refer the species to the *Euhopea* section of the genus. With this, as stated in *op. cit.* (1934), I am in entire agreement.

Collections examined:—

BURMA: Helfer 716 (Auth. Spec. of *Vatica Helferi* Dyer); Maymyo Nos. 7605 (Field No. 1929), 8329 Field No. 5199), & 12198 (Field No. 11049).

CAMBODIA: Pierre 1457 (Auth. Spec. of *Hopea dealbata* Hance).

SIAM: Foxworthy 11; S'pore 24235.

MALAY PENINSULA:

LANGKAWI: C.F. 7558, 7559, 7678, 7697, 8962, 12401, 20763, 20768, 21046, & 21462.

PERAK: C.F. 7048, 10406, 10413, 10235, 10417, 29043, 30806, 30917, & 30919.

*Hopea Helferi* is the tree known as *lintah bukit* on the island of Langkawi. It is probably better known in Burma, Cambodia, and Siam than it is with us, having been found in the Peninsula only as far south as Lenggong in Upper Perak. The botanical name *Hopea dealbata* Hance (the Cambodian name) has been given to the tree in Mal. For. Rec. 10, but the species is shown to be conspecific with the species described earlier from Burma, and the older epithet is chosen in accordance with the rules of botanical nomenclature.

* The union was first proposed by me in *Gdns. Bull. S.S.* 8: 22 (1934).

Hopea apiculata Sym.

Hopea apiculata Sym.

**Hopea apiculata** Symington, **sp. nov.** Plates XXI & XXII

Species *H. laxae* Sym., *H. resinosae* Sym., *H. pachycarpae* (Heim) Sym., etc. affinis, nuce parvo, glabro, apiculato, segmentis brevibus chartaceis instructo, differt.

*Branchlets* dark purple but usually covered with a pale tomentum, with decurrent elevate lines from the insertion of the petiole. *Leaves* lanceolate or oblong-lanceolate, gradually tapering to the acuminate apex, base subequal, rounded, or subcordate, about 13.0 cm. × 3.5 cm. to 21.0 cm. × 6.0 cm., glabrous on both surfaces (except midrib and main nerves above), pale yellow-brown (sometimes with a green tinge) above, stramineous (or glaucescent) beneath (v.s.); midrib slightly depressed and tomentose above, strongly elevate beneath; main nerves 11 to 14 pairs, at an angle of about 45° to the midrib, inconspicuous but tomentose above, elevate beneath; nervules joining the main nerves in fine more or less parallel lines, almost invisible above, distinct beneath; petioles 7.0–10.0 mm. long, terete, rugulose, tomentose; stipules caducous (not seen). *Panicles* axillary (sometimes in axils of recently fallen leaves) or terminal, usually solitary (rarely 2), 4.0–20.0 cm. long (usually a little shorter than the leaves), lax, stramineous, glabrous; branchlets about 1.5 cm. apart, each bearing 2 to 5 (usually 4) secund flowers. *Flowers* about 4.0 mm. apart, ovate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0 mm. long, minutely lentiginose. *Sepals* minutely subciliate along the apical margins, otherwise glabrous; two outer ovate-acute; three inner slightly larger, ovate-acuminate, hyaline at the edges. *Petals* oblong-oblique, tomentose on the portion exposed in bud "yellowish when fresh" (Wilkinson). *Stamens* 15, pairs alternating with single stamens; anthers oval, posterior cells slightly smaller than the anterior; filaments 1 to 3 times as long as the anthers, broad and flattened below, gradually narrowing to the filamentous upper portion; appendage to connective filiform, slightly longer than the filament and anther. *Ovary* with stylopodium shaped somewhat like an hour glass, glabrous; style short, glabrous; stigma minute, apparently simple. *Fruit:* stalk 1.0 mm. long or less, puberulous; calyx lobes chartaceous above, woody in the lower portion, shortly united at the base to form a woody receptacle, all glabrous; three inner lobes ovate-acute (sometimes obtuse or acuminate), about 11.0 mm. × 6.0 mm.; two outer lobes ovate-oblong to linear-oblong, obtuse at the apex, tending to curve inwards, usually unequal in size, 1 to 2 times as long as the inner lobes but rarely longer than the nut; nut ovate-conical, about 1.7 cm. × 1.0 cm.,

sparsely puberulous to glabrous, surmounted by a prominent apicula about 2.0 mm. long. *Embryo* essentially as in *Hopea pachycarpa* (Heim) Sym.

This extremely interesting species, which was collected for the first time in 1935, is the second member of the *Pierrea* group of *Hopea** from the Peninsula. The fruits are peculiar—they are intermediate between the "Balanocarpus" (wingless) type and the "Hopea" type with two long wings. Another peculiarity is the entire absence of the resinous exudation commonly found cementing together the base of the nut and the bases of the sepals of species in the group.

Collections examined:—

MALAY PENINSULA:

PERAK: C.F. 30322 (Type of flower of *H. apiculata* Sym.); G. Wilkinson; Compt. 8, Kenas Circle, Bubu Reserve, flat land; 29th Jan. 1935; flower. Field Note by Mr. Wilkinson—"Tree, height 50–75 feet; first branch 35–45 feet; diam. breast high 9–12 in., crown dense, spherical; bark white and black, smooth (one tree was fissured—fissures from small 2 in. cracks to 12 in. deep vertical gashes); buttresses absent to 3 feet in height; bark ¼ in. and over; stem not usually absolutely straight, tapers to 8" diam. at first branch; branches many and much forked, leave the stem pointing slightly upwards but are pendulous after half their length; regeneration very dense, leaves of seedlings larger than those of mature tree." C.F. 16828, 39104, 39105, & 39106 (Type of fruit of *H. apiculata* Sym.).

*Hopea apiculata* is a "new" species recently discovered by Mr. Wilkinson in Bubu, and Mr. Carcenac in Bruas, Forest Reserves. Both officers report that the tree regenerates prolifically but that it does not attain large dimensions. The timber appears to approach "balau" in quality and the species may be useful as a pole crop. The leaves are very similar to those of *chengal* (Balanocarpus Heimii) and Mr. Carcenac reports that these species are commonly confused in young stages. The only vernacular name so far reported for *H. apiculata* is *resak*, but this is hardly appropriate and should not be encouraged.

**Hopea resinosa** Symington, **nom. nov.**: *Balanocarpus pubescens* Ridl., Fl. Mal. Penins. 1: 247 (1922); Foxw., Mal. For. Rec. 10: 147 (1932); Sym. in Gdns. Bull. S.S. 8: 28 & 32 (1934), in obs. Plate XXIII.

* Vide *Gdns. Bull.* S.S. 8: 27 & 32 (1934).

Hopea resinosa Sym.

This species was first collected in the Kuantan district of Pahang by Forest Ranger Yeop, in 1919. Ridley examined this collection (of fruit only) and described it as *Balanocarpus pubescens* in 1922. Foxworthy, with additional material, gave a more complete description in 1932.

I have already discussed the systematic position of this plant in *loc. cit.* I have stated that the species is a typical member of the *Pierrea* group of *Hopea* and is very close indeed to *Hopea pachycarpa* (Heim) Sym. In making the transfer to *Hopea* a new specific name must be given, *Hopea pubescens* being already occupied.

Foxworthy's description, together with the plate published with this paper, should provide adequate definition of the species. I might add some remarks concerning the species with which *H. resinosa* is most liable to be confused in the herbarium, *i.e. H. pachycarpa* and *H. philippinensis*. In all essential characters *H. resinosa* is almost identical with the former, but may be distinguished without difficulty by the *facies* of the dried specimen. In *H. pachycarpa* the leaves are more coriaceous and more glabrous, have somewhat thicker petioles and less distinct reticulations, and dry chocolate-brown above as opposed to pale green in *H. resinosa*. The dried sterile specimen of *H. resinosa* has a *facies* very like that of *H. philippinensis*, but may be distinguished by the less inæquilateral leaf and the absence of domatia in the nerve axils. Fruiting material is, of course, quite distinct, *H. philippinensis* having two long wings and *H. resinosa* none. Flowering material, on the other hand, is very similar in both species but in *H. resinosa* the sepals are subequal in flower, while in *H. philippinensis* two sepals are clearly differentiated even in bud.

Collections examined:—

MALAY PENINSULA:

PAHANG: C.F. 3602 *a* & *b* (Auth. spec. of *B. pubescens* Ridl.), 15687, & 29671.

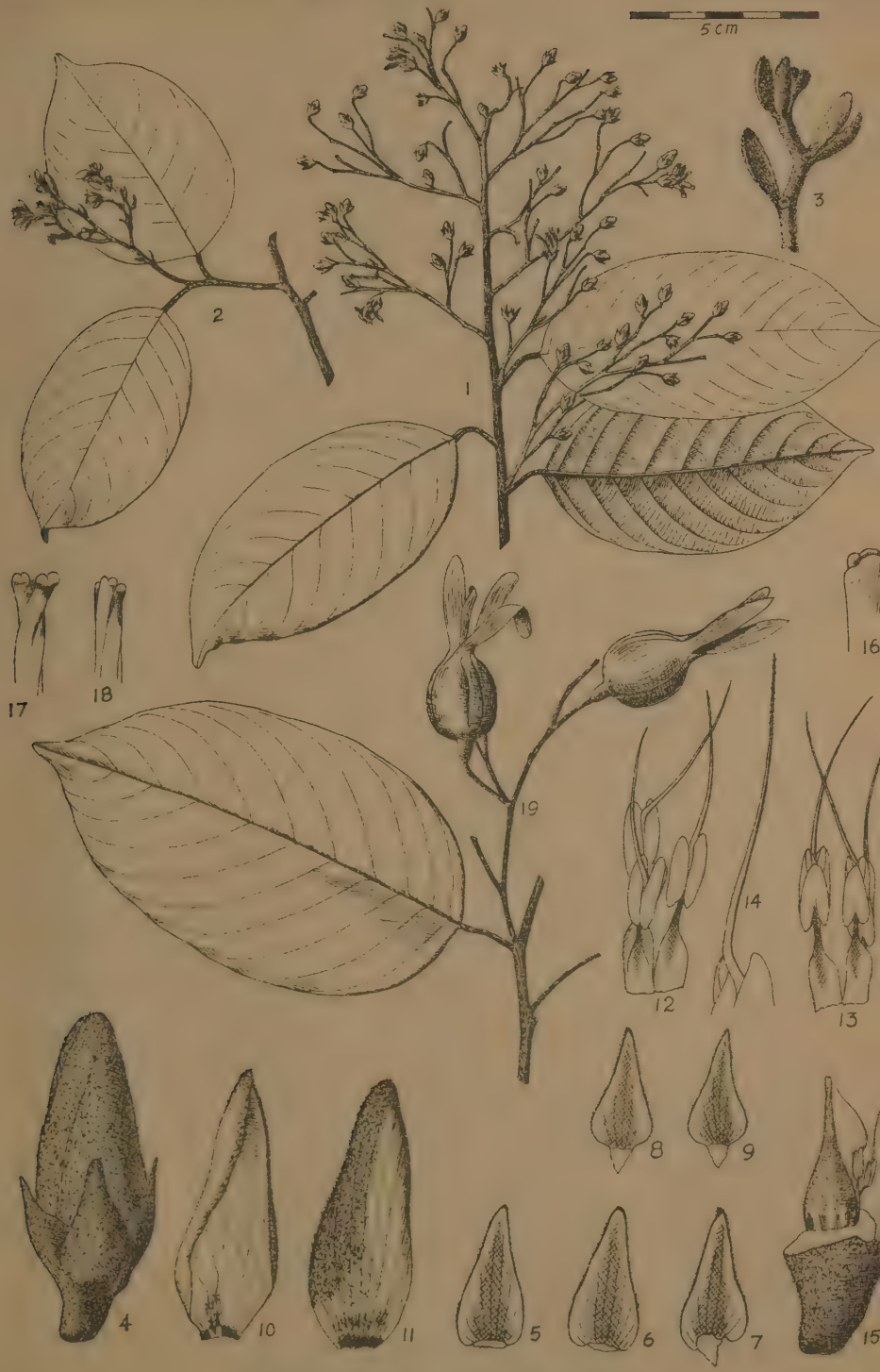
JOHORE: S'pore 28514.

A small dipterocarp with smooth bark and stiltroots has been collected several times, from the Kuantan and Rompin districts of Pahang, under the vernacular names of *merawan mata kuching* and *boyan* (said to be a Sakai name). In 1922 it was described as *Balanocarpus pubescens* but it is shown that the species is more correctly referable to the genus *Hopea*. The transfer is here made and a new specific name "resinosa"* is chosen because a *Hopea pubescens* already exists.

* This name is descriptive of the peculiar resinous coating on the fruits.

**Shorea bentongensis** Foxw., Mal. For. Rec. 10: 169 (1932) tab. XII: *Shorea pahangensis* Foxw., op. cit. 193, tab. XV, non Ridl. Ms. in Herb. Kew (= S. bractiolata Dyer). Plate XXIV.

*Branchlets* dark with a red tinge, tawny to ferruginous tomentose towards the ends. *Leaves* oval or ovate to elliptical, acuminate at the apex (acumen sometimes exceeding 1.0 cm. long), rounded at the base, from about 8.0 cm × 3.7 cm. to 16.0 cm. × 8.5 cm., glabrous except on the midrib above, minutely lepidote and sparsely stellate-hairy on the nerves beneath, drying light brown or yellow-green on both surfaces; midrib depressed and tomentose above, strongly elevate striate puberulous beneath; main nerves 11 to 16 pairs, inconspicuous above, prominent and puberulous beneath; nervules joining the main nerves in numerous more or less parallel lines, obscure above, prominent on the lower surface; petioles 0.8–1.3 cm., rugulose, channeled, dark, tomentose when young, later puberulous; stipules caducous, ovate to linear-oblong, subfalcate, 8.0 mm. × 4.0 mm. to 10.0 mm. × 3.0 mm., 3 to 5-nerved, pubescent (sapling specimens only seen); buds small, flattened, ferruginous tomentose. *Panicles* mainly axillary towards the ends of the branchlets, subtended by leaves or caducous bracts, usually solitary, up to 8.0 cm. long, striate, tomentose when young, later pale puberulous; main axis of panicle alternately branched; branchlets at irregular intervals, solitary or in pairs, simple or bifurcate, usually 2 to 3-flowered, subtended by caducous bracteoles. *Flowers* each subtended by a caducous bracteole or paired bracteoles, ovate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0–2.0 mm. long, pale tomentose. *Sepals* pale tomentose outside and, on the upper portion, inside; three outer ovate-oblong, obtuse or acute; two inner ovate-acuminate, thin at the edges. *Petals* ovate-oblong, pale tomentose outside (except for a narrow portion along one edge), pale yellow. *Stamens* normally 15 (15 to 20, Foxworthy), pairs alternating with single stamens; anthers oblong or ovate-oblong, posterior cells slightly smaller than the anterior; filaments 1 to 2 times as long as the anthers, broad and flattened below, narrowing gradually to the filamentous upper portion; appendage to connective 2 to 3 times as long as the anther, filiform, minutely setose in upper third (only visible under high magnifications). *Ovary* ovate-conical, tapering gradually into the style, minutely tomentose; style as long as the ovary, the upper half glabrous; stigma minute, obscurely (usually 3-) lobed. *Fruit* (immature specimens only seen)—a nut with 5 rudimentary wings; stalk thick, about 4.0 mm. long, with a




Shorea bentongensis Foxw.

**Shorea inaequilateralis Sym.**

few stellate hairs; bases of calyx lobes forming an ovate-orbicular covering around the nut, woody, glabrescent or sparsely puberulous; three wings linear, acute or obtuse, up to 3.5 cm. × 1.0 cm., about 7-nerved, puberulous when young (material inadequate for further description).

*Shorea bentongensis* was first collected in the Bentong district of Pahang in 1919 and described by Foxworthy in 1932. At that time the only flowering specimens available were C.F. 5875 (cited by Foxworthy under *S. globifera*) and C.F. 15774 upon which Foxworthy based his *Shorea pahangensis*. This latter specimen bears immature inflorescences and does indeed, at first glance, appear very different from the type of *S. bentongensis*. Careful study, however, with the added assistance of a recent excellent flowering collection of the species, makes it quite clear that *S. bentongensis* Foxw. and *S. pahangensis* Foxw. are conspecific.

The systematic position of this species presents no difficulties—it is a typical member of the section *Anthoshorea*.

Collections examined:—

MALAY PENINSULA:

PAHANG: C.F. 3937, 15632, 15774 (Type of *S. pahangensis* Foxw.), 17275, 26215, 26505 (Type of *S. bentongensis* Foxw.), & 28052.

SELANGOR: C.F. 27898 & 29801.

JOHORE: C.F. 5875.

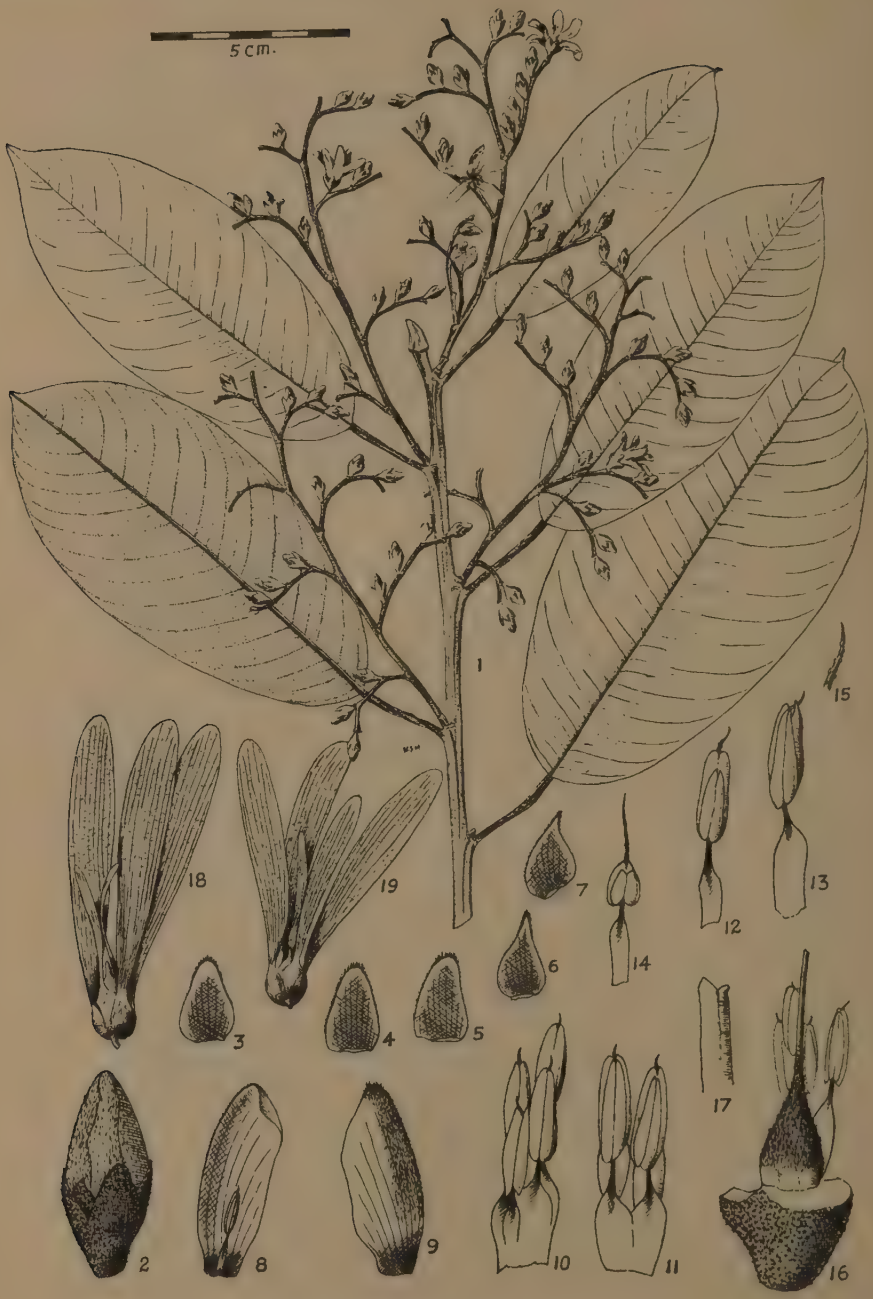
*Shorea bentongensis* is known to forest officers in Pahang West as *meranti mengkai*. It is shown that a specimen described in Mal. For. Rec. 10 as *Shorea pahangensis* is not specifically distinct and the two species are united, the name *Shorea bentongensis* being preserved.

**Shorea inæquilateralis** Symington, **sp. nov.**: *"semayor"*, Durant, Rep. For. Brunei pp. 37 & 42 (1933). Plate XXV.

Species floribus *S. palembanicae* Miq. affinis, sed foliis inæquilateralibus breve-petiolatis, stipulis bracteisque panicularum persistentibus, nuce longe-alato rostellato differt.

*Branchlets* ridged, tawny tomentose (dark purple-red underneath the tomentum). *Leaves* inæquilateral, oval to elliptic-oblong, long-acuminate at the apex (acumen up to 2.0 cm. long), cordate at the base, or rounded on one side, and cordate on the other, about 8.0 cm. × 3.5 cm. to 14.0 cm. × 6.0 cm., sparsely stellate-hairy (except midrib) above, sparsely stellate-hairy to densely silvery tomentose

beneath, drying usually to a dull purple-red above, stramineous to silvery beneath; midrib slightly depressed and densely tomentose above, elevate stellate-tomentose or sparsely stellate-hairy and striate beneath; main nerves about 11 to 13 pairs, inconspicuous above, elevate and hairy or tomentose beneath; intermediary nerves occasionally present; nervules joining the main nerves in more or less parallel lines, inconspicuous above, more prominent beneath; petioles 0.7–1.0 cm. long, thick, rugose, tomentose; stipules oblong-lanceolate, subcymbiform, about 2.0 cm. long, puberulous, persistent towards the ends of the branchlets. *Panicles* axillary (or subaxillary) and terminal, solitary, when axillary about as long as the leaves, tawny tomentose at the base, hairy towards the ends, usually consisting of 2 to 4 regularly alternating branchlets and terminating in an apparently sympodial arrangement; peduncles about 2.0–4.0 cm. long, with two subopposite, cymbiform, bifid, persistent bracts about the middle; branchlets subtended by persistent stipular bracts about 1.0 cm. long, each bearing 2 to 3 secund flowers; bracteoles subtending the flowers caducous (not seen). *Flowers* about 0.8 cm. apart, ovate-lanceolate in bud, 1.5–2.0 cm. long (including the pedicel); pedicel 2.0 mm. long, pale tomentose. *Sepals* tomentose outside and hairy on the upper portions inside; three outer oblong-lanceolate, acute; two inner ovate-acuminate, slightly shorter. *Petals* linear-oblong, rounded at the apex, silvery tomentose outside (on the portion exposed in bud), "white striped with red" (native collector). *Stamens* 15, of two different lengths, pairs alternating with single stamens; filaments broad at the base, filamentous above, 1 to 2 times as long as the anthers; anthers oblong, posterior cells smaller than the anterior; appendage to connective filiform, slightly longer than the filament and anther, minutely setose towards the end (only visible under high magnifications). *Ovary* ovate-conical, tapering gradually into the style, villous (except for the glabrous basal portion); style cylindrical, about twice as long as the ovary, pilose on the lower half, glabrous above; stigma minute; apparently simple. *Fruit*—a 5-winged nut; stalk about 4.0 mm. long, sparsely hairy; bases of accrescent calyx lobes thickened and woody, embracing one half of the nut, sparsely hairy; three outer wings subequal, linear-spathulate, acute or rounded at the apex, narrowed at the base, about 11.0 cm. × 1.5 cm. to 14.0 cm. × 2.0 cm., 9 to 11-nerved with conspicuous transverse nervules, sparsely stellate-puberulous on both surfaces, red-brown when mature; two inner wings subequal, about two thirds as long as the outer wings, acute at the apex, about 0.4–1.0 cm. broad, about 8-nerved, texture as in large wings; nut ovate, rostellate, about 2.5




Shorea albida Sym.

cm. × 1.4 cm., minutely pale tomentose on the exposed portion; rostellum up to 1.0 cm. long, villous below, filiform and glabrous above (upper portion frequently broken off).

I am unable to suggest the exact systematic position of this species but, on the flower structure, it appears to be more closely related to a group of *Shorea* which includes *Shorea palembanica* Miq., *S. pauciflora* King, and *S. Kunstleri* King, than to any other groups I have studied.

Collections examined:—

SARAWAK: For. Dept. Sar. 153 (TYPE of fruit of *S. inaequilateralis* Sym.); B. J. C. Spurway; Bukit Lima F.R., Compt. 8, freshwater swamp; 3rd May 1932; mature fruit. Field notes—vern. name, *"semayur"*; tree 70 feet high, 3 feet 4 in. girth. Foxw's. coll. s.n., Aug. 1908; For. Dept. Sar. 170.

BRUNEI: C.F. 30351 (Type of flowers of *S. inaequilateralis* Sym.); Zainal; Kuala Belait, swamp; 8th March 1934; flower. Field notes—vern. name, *"semayur"*; tree 120 feet high, 84 in. girth; flower white striped with red; wood reddish, used for posts and planks.

C.F. 28698, 30358, 30567, & 39686.

A dipterocarp called *maior* or *semaior* was collected in the fresh-water swamps of Sarawak in 1908 and again in 1932. Subsequently it has been collected several times by Messrs. Durant and Smith, from similar habitats in Brunei. Mr. Durant in his report on the forests of Brunei, 1933, says of this tree—"A tree of freshwater swamps. In places it occurs in groups, but does not seem to be generally abundant. The timber is of the type known in the Federated Malay States as *damar laut merah* (Shorea Kunstleri) and is used for general construction and for boat building, it is not very durable in contact with the ground." Mr. Smith reports that the bark is greyish brown with deep longitudinal fissures. The species is here described as *Shorea inaequilateralis*—the specific name being descriptive of the unequal-sided leaf. The most usual rendering of the vernacular name appears to be *semayur*.

**Shorea albida** Symington, **sp. nov.**; Thomas in Mal. Forester 3: 147 (1934): *"selangan paya"*, Durant, Rep. For. Brunei pp. 37, 41, & 42 (1933): *"seringawan"*, Smith, Forestry in Brunei pp. 2 & 4 (1935). Plate XXVI.

Species nova, nullæ speciei generis adhuc discriptæ notabiliter affinis, ramulis juvenibus foliisque lentiginosis stellato-lepidotis cognoscetur: flores sectioni *Anthoshoreae* affines, sed staminibus numerosioribus (20 to 25), antheris breve-appendiculatis differt.

*Branchlets* coarse, flattened, lentiginose, densely cinereous stellate-tomentose when young; later becoming terete, glabrescent, dark or glaucescent. *Leaves* elliptical, elliptic-oblong, or elliptic-obovate, shortly (usually blunt) acuminate at the apex, rounded at the base, about 9.0 cm. × 4.0 cm. to 15.0 cm. × 7.0 cm., glabrous and usually drying to a dull light red-brown above, lentiginose and densely close stellate-tomentose (at first whitish but becoming darker) beneath; midrib depressed above, elevate and cinereous tomentose beneath; main nerves about 17 to 24 pairs, not elevate above (frequently inconspicuous), slightly elevate and more distinct beneath; 1 or sometimes 2 intermediary nerves (up to 1.5 cm. long) occur between the main nerves; nervules in numerous parallel lines joining the main nerves, invisible but indicated on the lower surface by rows of large stellate hairs; petioles 2.0–3.0 cm. long, rugose, cinereous stellate-tomentose; stipules caducous (not seen). *Panicles* axillary and terminal, solitary, usually shorter than the leaves; main branches flattened, texture as in young branchlets; ultimate branchlets about 4 to 10, about 1.0 cm. apart, regularly alternating, simple or bifurcate (sometimes from the base), about 1.0–3.0 cm. long, usually 3 to 4-flowered, silvery tomentose. *Flowers* secund, about 0.8 cm. apart, subsessile, about 1.0 cm. long in mature bud. *Sepals* densely silvery tomentose outside and along the upper margin inside; three outer ovate-oblong, obtuse; two inner ovate-acute or acuminate, slightly shorter. *Petals* linear-oblong, blunt minutely silvery tomentose outside with a dense hairy apical fringe, glabrous on the side covered in bud, yellow (native collector). *Stamens* 20 to 25, variable in length; filaments broad and flattened below, narrowing rather abruptly to the filamentous upper third; anthers oblong,* slightly broader at the base, usually longer than the filaments, posterior cells smaller than the anterior (similar to those of *Anisoptera laevis* Ridl.); appendage to connective—a short, curved awn (seen to be slightly pappilose under high magnifications). *Ovary* ovate-conical, tapering gradually into the style, glabrous at the base, villous above; style cylindrical, about one and a half times as long as the ovary, villous below, glabrous and often elliptical in cross-section in the upper half; stigma not enlarged, simple or minutely bifid. *Fruit*—a 5-winged nut;† stalk 1.0–2.0 mm. long, stellate-hairy; bases of accrescent calyx lobes thickened and woody, embracing rather more than one half of the nut, stellate-hairy; three outer calyx lobes linear-spathulate, about 6.0 cm. × 1.0 cm. to 7.5 cm. × 1.3 cm.,

* The abnormal stamen found in one flower, and figured in Plate XXII No. 14, is of interest.

† The fruits described are possibly not quite mature.

Shorea ochracea Sym.

about 10-nerved, with conspicuous obliquely transverse nervules, puberulous and with a few large stellate hairs at the base, dull light brown when mature; two inner lobes linear, 2.0 cm. × 0.3 cm. to 4.0 cm. × 0.5 cm., of similar texture to the outer wings; nut globulose, rostellate, about 1.0 cm. long, pale tomentose; rostellum 2.0–3.0 mm. long, villous (frequently broken).

This species is most readily referable to the section *Anthoshorea* but is is quite distinct from any member of that group that I have examined. Sterile material is readily recognizable on account of the characteristic pale stellate-lepidote tomentum on the under surfaces of the leaves and on the young twigs.

Collections examined:—

SARAWAK: For. Dept. Sar. 154 (TYPE of fruit of *S. albida* Sym.); B. J. C. Spurway; Bukit Lima F.R., Compt. 1, freshwater swamp; 3rd May 1932; fruit. Field notes —vern. name, "*meraka paya*", tall tree, 140 feet high, 9 feet 10 in. girth.

BRUNEI: For. Dept. Sar. 174. C.F. 30353 (TYPE of flower of *S. albida* Sym.); Zainal; Kuala Belait, swamp; 23rd March 1934; flower. Field notes—vern. name, "*seringawan*", tree 130 feet high, and 60 in. girth, flower yellow, plants blackish, bark used for making walls of houses.

C.F. 28680, 28699, 28700 ,30565, & 30588.

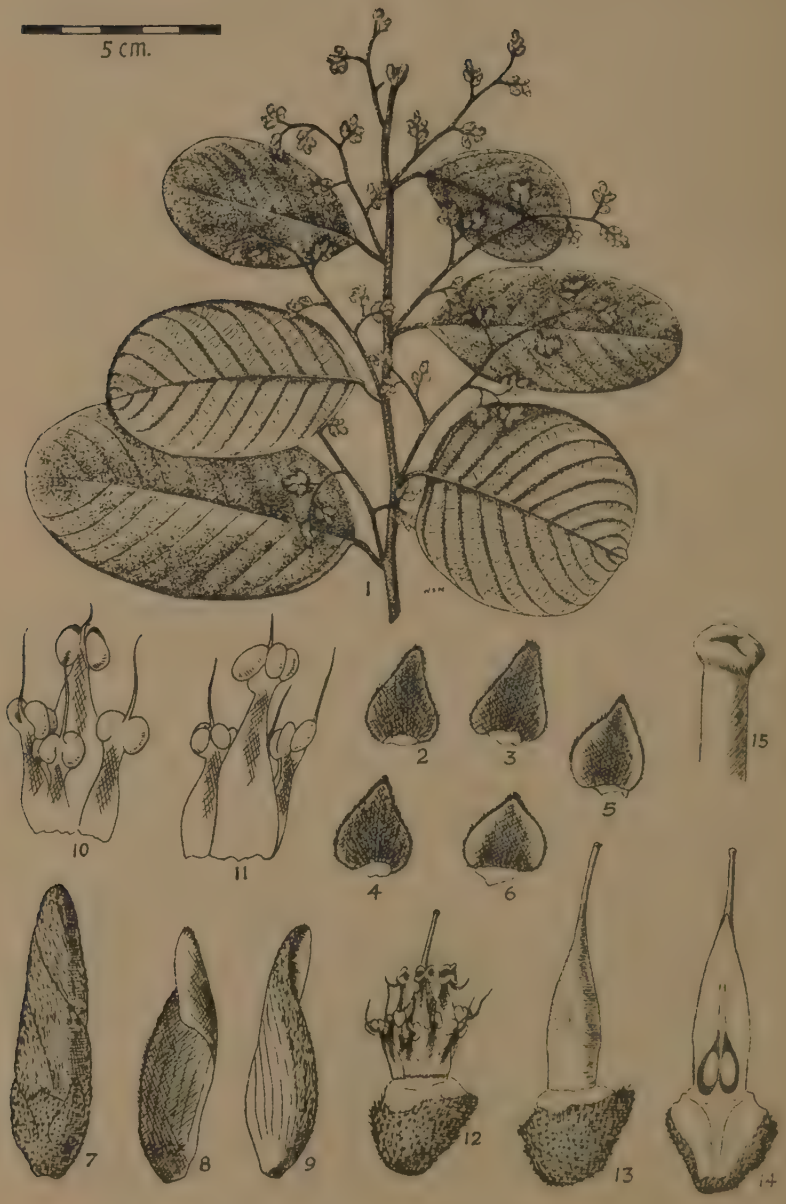
Specimens of a tree, called *seringawan* in Brunei, were first collected in Sarawak in May 1932 by Mr. Spurway. Subsequently Messrs. Durant and Smith have made several collections and drawn attention to the comparative abundance of the species in the coastal swamp forests of Brunei. With a view to the possible importance of the timber for export, pilot tests have been carried out in our laboratories at Sentul, the timber being favourably reported upon as a "good-grade red meranti". It is here described and named *Shorea albida*.

**Shorea ochracea** Symington, **sp. nov.**; non *S. ochracea* Dyer, Ms. in Herb. Kew (= S. inappendiculata Burck): "*majau*", Durant, Rep. For. Brunei p. 43 (1933). Plate XXVII.

Species nova sectioni *Anthoshoreae* affinis, sed omnibus speciebus ramulis crassis ferrugineo-lepidotis, foliis magnis ochraceo-lepidotis, bracteis bracteolisque magnis persistentibus, fructu alis subauriculatis facile distinguenda.

*Branchlets* thick, terete, ferruginous furfuraceous when young, later cinereous. *Leaves* oblong and elliptic-oblong, shortly blunt-acuminate at the apex, cordate at the base.

averaging about 21.0 cm. × 12.0 cm. but may be considerably larger, coriaceous, glabrous and pale yellow-or brown-glaucescent above, bright ochraceous to ferruginous lepidote beneath; midrib depressed above, elevate, striate, lepidote, and thick at the base beneath; main nerves about 30 to 36 pairs, inconspicuous above, elevate beneath; nervules joining the main nerves in numerous parallel lines, obscure above, subobscure or distinct beneath; petioles 2.0–3.0 cm. long, thick, scabrous, sparsely ochraceous-ferruginous lepidote; stipules oblong, subfalcate, about 1.5 cm. × 0.6 cm., ferruginous lepidote, caducous. *Panicles* terminal and axillary towards the ends of the branchlets, solitary, 6.0–14.0 cm. long, ferruginous-ochraceous lepidote to stellate-tomentose; peduncles 2.0–3.0 cm. long, bracteate; branchlets 5 to 8, regularly alternating, 1.0–2.0 cm. apart, racemose, each subtended by large, papyraceous, stellate-hairy, persistent, foliolar (sometimes absent) and stipular bracts. *Flowers* about 6 per branchlet, each subtended and embraced by large papyraceous, stellate-hairy, stipular bracteoles; mature bud about 14.0 mm. long (including the pedicel); pedicel 1.5 mm. long, stellate-tomentose. *Sepals* dense pale stellate-tomentose outside and puberulous towards the apex inside; three ovate-lanceolate, rounded at the apex, cordate at the base; two ovate-acuminate, slightly shorter, thin at the edges. *Petals* elliptice-ovate, tomentose outside on the portion exposed in bud, sparsely puberulous inside and on the remaining portion outside. *Stamens* 15, of three lengths, pairs alternating with single stamens; filaments linear, flattened, slightly narrowed above; anthers oblong, about two thirds to as long as the filaments, posterior cells smaller than the anterior; appendage to connective awl-shaped, recurved, about as long as the anther. *Ovary* ovate-conical, tapering gradually to the style, silvery pilose (except at the base); style cylindrical, longer than the ovary, silvery hairy (except for a short glabrous apical portion); stigma minute, obscurely, minutely (sometimes 3-) notched. *Fruit*—a 5-winged nut: stalk 4.0–5.0 mm. long, stellate-hairy; calyx lobes free almost to the base, but appressed to, and obscuring, the lower half of the nut; three outer calyx lobes linear-oblong, rounded at the apex, subauriculate at the base, about 8.0 cm. × 1.4 cm., puberulous on the free portions, densely ochraceous-pilose outside at the base, 9 to 11-nerved; two inner lobes broad and embracing the lower portion of the nut at the base, narrow and long-acuminate in the free portion ,usually unequal, the longest up to about 3.0 cm., few-nerved, similar to the large lobes in texture; nut ovate-conical, rostellate, about 1.3 cm. long, densely ochraceous-pilose; rostellum about 0.5 cm. long, hairy except at the apex (frequently broken off).




Shorea scabrida Sym.

*Shorea ochracea* has many of the characters typical of the section *Anthoshorea* and I have little hesitation in referring it to that group. The large leaves, the thick branchlets, the ferruginous-ochraceous scurfy tomentum, the large, persistent bracts and bracteoles of the inflorescence, and the rather unusual subauriculate wings on the fruit, make this a very distinct and easily-recognizable species.

Collections examined:—

SARAWAK: For. Dept. Sar. 167 (TYPE of flower of *S. ochracea* Sym.); B. J. C. Spurway; Mirirai, Balleh, hill forest; 27th Nov. 1933; flower. Field note—vern. name, "*ruruk*", tree 90 feet high, 5 feet girth.

BRUNEI: C.F. 30363 (TYPE of fruit of *S. ochracea* Sym.); Abang Bujang; Sungei Keduan, hill side; 25th Nov. 1934; fruit. Field note—vern. name, "lon (Sarawak name)", tree 140 feet high, 156 in. girth, flower yellowish (probably this refers to the bracts. C.F.S.), fruit small, 3-winged.

C.F. 28712, 30612, & 39603.

BRITISH NORTH BORNEO: For. Dept. No. 67 (Villamil).

This species was first collected by Vallamil in British North Borneo in 1915. Additional collections (including flower and fruit) from Sarawak and Brunei have made it possible to describe the species. The name *Shorea ochracea* is here given to it. The timber appears to belong to our "white meranti" class. As yet we know little concerning the abundance of the tree but it is evidently quite widely distributed on low hills or undulating land. The vernacular names *lon, majau,* and *raruk* have been recorded.

**Shorea scabrida** Symington, **sp. nov.**

Species *S. Teysmannianae* Dyer, *S. leprosulae* Miq., *S. pavifoliae* Dyer, etc. affinis, foliis parvis, obovatis, infra scabridis distincta.

*Branchlets* ferruginous stellate-tomentose towards the tips, later becoming glabrescent, lenticellate, black, with decurrent-elevate lines. *Leaves* usually obovate, but may be oval to elliptic-oblong, rounded, retuse, or rarely blunt-acuminate, at the apex, acute to rounded at base, averaging about 6.0 cm. × 3.5 cm., glabrous (except on ridrib and main nerves) and dull purple-brown to black above, shining light to dark brown and stellate-hairy on the nerves beneath; midrib depressed and tomentose above, elevate, striate, and furnished with coarse, tufted, stellate hairs beneath; main nerves about 9 to 12 pairs, slightly depressed and tomentose towards the midrib above, elevate and coarsely stellate-hairy

beneath; nervules joining the main nerves in wavy subparallel lines, fine (sometimes obscure) on both surfaces, with occasional stellate hairs on the lower surface; petioles 0.7–1.5 cm. long, ferruginous stellate-hairy to tomentose; stipules oblong, about 5.0 mm. × 2.5 mm., ferruginous stellate-tomentose outside, caducous. *Panicles* axillary and terminal, solitary, up to 8.0 cm. long, (usually shorter), occasionally compound but usually with about 8 regularly alternating branchlets, coarsely ferruginous stellate-hairy; peduncles short; branchlets about 0.7 cm. apart, simple or bifurcate, about 1.0 cm. long, furnished with 3 to 7 closely set distichous flowers. *Flowers* oblong-lanceolate, up to 8.0 mm. long in bud, sessile. *Sepals* densely tawny stellate-tomentose outside, glabrous inside; three ovate-obtuse; two broadly ovate, acute, slightly shorter than the others, thin at the edges. *Petals* oblique-oblong, fimbricate at the apex, pale villous on the portion exposed in bud, "white" (For. Dept. Sar. 171). *Stamens* 15, of three lengths, pairs alternating with single stamens; filaments broad, flattened, subgibbous at the base, gradually narrowing above, when mature 4 to 10 times as long as the anthers; anthers globular, cells subequal, appendage to connective as long as the anther (large inner row), 2 to 3 times as long (shorter outer rows), at first erect, latter curved and deflexed. *Ovary* and stylopodium elongate-conical, glabrous on the lower portion, finely tomentose above; style cylindrical, about half as long as the ovary with stylopodium, glabrous (except where it joins the stylopodium); stigma slightly enlarged, obscurely 3-lobed. *Fruit* unknown.

It is not possible to refer this species to any of the sections of the genus *Shorea* as they are at present defined. The species to which *Shorea scabrida* is closely allied have usually been referred to the sections *Pinanga* and *Mutica*. Among these species are *Shorea leprosula* Miq., *S. Teysmanniana* Dyer, *S. parvifolia* Dyer, *S. lepidota* (Korth.) Bl., *S. platycarpa* Heim, *S. rugosa* Heim., and many others. Collectively these species produce most of the red timber known in the Malay Peninsula as "red meranti". The most distinctive diagnostic character of *S. scabrida* is the small, obovate leaves, which, being sparsely furnished with large, stellate hairs on the veins on the lower surface, are rough to the touch yet comparatively glabrous in appearance.

Collections examined:—

SARAWAK: Haviland 2227 (Kew & Mus. Kuching), & s.n. 25th March 1893 (Mus. Kuching); For. Dept. Sar. 171 (TYPE of flower of *S. scabrida* Sym.) Md Yusop;

Bukit Lima Forest Reserve, swamp; 7th Feb. 1935; flower. Field note—vern. name, *perawan lop*, small tree 72 feet high, 4 feet girth, flower white.

BRUNEI: C.F. 30513, 30552, & 30619.

*Shorea scabrida*, which is here described, was first collected by Haviland in 1892. Several additional collections have recently been made by forest officers in Sarawak and Brunei, where the tree appears to occur on coastal hills. Mr. Smith reports that the bark is like *meranti tembaga* (Shorea leprosula). These species are, actually, closely related botanically, and one would expect to find that, like *Shorea leprosula*, *Shorea scabrida* produces timber of the "red meranti" class. The only vernacular name so far recorded for *S. scabrida* is *meraka telor* (Kedayan).

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## Explanation of Plates

Plate XVI. **Shorea guiso** (Blco.) Bl. 1, flowering twig. 2, twig with immature fruits. 3, twig with mature fruit. 4, mature flower bud. 5, expanding flower. 6 & 7, petal from mature flower. 8 to 12, sepals. 13, ovary—sepals & petals removed. 14, style & stigma. 15, longitudinal section through ovary. 16—24, stamens. (Drawings of 1 & flower parts based mainly on C.F. 17788; 2 on C.F. 8334; and 3 on C.F. 9508). *Scale applies to* 1, 2, & 3 *only*.

Plate XVII. **Shorea ochrophloia** E. J. S. ex Sym. 1, sterile twig. 2, flowering twig. 3, ripe fruit. 4, flower bud. 5, expanded flower. 6 & 7, petal from expanded flower. 8—12, sepals. 13, ovary—sepals & petals removed. 14, longitudinal section through ovary. 15 to 19, stamens. (1 & 3 based on C.F. 29016; 2 & flower parts on C.F. 27482). *Scale applies to* 1, 2, & 3 *only*.

Plate XVIII. **Shorea collina** Ridl. 1, flowering twig. 2, leaf showing cordate base. 3, 4, & 5, mature fruits. 6, expanded flower. 7 & 8, petal from expanded flower. 9, 10, & 11, large sepals. 12 & 13, smaller sepals. 14, ovary. 15, section through ovary. 16, stigma. 17, 18, 19, 20, & 21, stamens. (Flower drawings based on C.F. 319; fruit on C.F. 9509 & 29336). *Scale applies to* 1—5 *only*.

Plate XIX. **Shorea Foxworthyi** Sym. 1, flowering twig. 2, ripe fruit. 3, mature flower. 4 & 5, inner sepals. 6, 7 & 8, outer sepals. 9, petal from mature flower (posterior). 10, petal (anterior). 11, ovary—sepals & petals removed. 12, 13, 14, & 15, mature stamens. 16, long. section through ovary. 17, end of style & stigma. 18, cross—section of ovary. (Flower drawings based on C.F. 30301; fruit on C.F. 28804). *Scale applies to* 1 & 2 *only*.

Plate XX. **Hopea Helferi** (Dyer) Brandis. 1, flowering twig. 2, cordate leaf from sapling. 3, mature fruits. 4 & 5, immature fruits. 6, expanded flower. 7 & 8, flower buds. 9 & 10, thick outer sepals. 11, 12, & 13, inner sepals. 14 & 15, petal. 16, ovary. 17, longitudinal section through ovary. 18 & 19, stamens. (1 & drawings of flower parts based on Maymyo 7605 (F. No. 1929); 5 on C.F. 21462). *Scale applies to* 1—5 *only*.

Plate XXI. **Hopea apiculata** Sym. 1, flowering twig. 2, panicle with immature fruits. 3, expanding flower. 4, flower bud. 5 & 6, petal from expanded flower. 7, 8, & 9, inner sepals. 10 & 11, outer sepals. 12, ovary. 13 & 14, stamens. 15, stigma (1 and drawing of flower parts based on C.F. 30322; 2 on C.F. 39105). *Scale applies to* 1 & 2 *only*.

Plate XXII. **Hopea apiculata** Sym. 1, 2, & 3, mature fruits. 4, 5, 6, & 7, embryo removed from pericarp. 8, pericarp split on germination. 9, embryo just before germination. 10, embryo—germination commenced. 11, placenta. 12—18; stages in germination; 12 & 13=3 days after sowing, 14=4 days, 15=9 days, 16 & 17=17 days, and 18=81 days. (Drawings authenticated by C.F. 39106). *Scale applies to all except* 18 *which is* × ½.

Plate XXIII. **Hopea resinosa** Sym. 1 & 2, flowering twigs. 3, flower. 4, flower bud. 5 & 6, petals from mature bud. 7, 8, & 9, outer sepals. 10 & 11, inner sepals. 12, ovary and stamens. 13, ovary—perianth and stamens removed. 14, stigma seen from above. 15 & 16, stamens. 17, mature fruit with resinous coating. 18, mature fruit—resinous coating removed. 19, 18 seen from above. 20, 18 with accrescent sepals removed. 21, pericarp dissected to show mode of splitting on germination. 22, 24, 25, & 26, embryo. 23, placenta. (Drawings of flowering twigs and flower parts based on C.F. 17193; fruit & embryo on C.F. 3602). *Scale applies to* 1 2, & 17 *only*.

Plate XXIV. **Shorea bentongensis** Foxw. 1, flowering twig. 2, twig with young inflorescence. 3, branchlet of inflorescence from 2—flowers removed (showing bracteoles). 4, flower bud. 5, 6, & 7, outer sepals. 8 & 9, inner sepals. 10 & 11, petal. 12 & 13, stamens. 14, appendage (highly magnified). 15, ovary. 16, 17, & 18, stigmas. 19, twig with immature fruits. (1 and drawings of flower parts based on C.F. 26215; 2 on C.F. 15774; 19 on C.F. 26505). *Scale applies to* 1, 2, & 19 *only*.

Plate XXV. **Shorea inaequilateralis** Sym. 1, flowering twig. 2, stipule. 3 & 4, pair of bi-fid bracts from inflorescence. 9, mature flower bud. 10, 11, & 12, outer sepals. 13 & 14, inner sepals. 15 & 16, petal. 17, 18, & 19, stamens. 20, tip of appendage highly magnified. 21, ovary. 22, immature fruit. 23, mature fruit. (Drawings of twig & flower parts based on C.F. 30351; 22 on C.F. 30358; 23 on For. Dept. Sar. 153). *Scale applies to* 1, 22, & 23 *only*.

Plate XXVI. **Shorea albida** Sym. 1, flowering twig. 2, flower bud. 3, 4, & 5, outer sepals. 6 & 7, inner sepals. 8 & 9, petal. 10, 11, 12, & 13, stamens. 14, abnormal stamen. 15, appendage to connective highly magnified. 16, ovary. 17, stigma. (Drawing of flowering twig and flower parts based on C.F. 30353; fruits on For. Dept. Sar. 154). *Scale applies to* 1, 18, & 19 *only*.

Plate XXVII. **Shorea ochracea** Sym. 1, flowering twig. 2, ultimate branchlet—bracteoles removed. 3, bract from peduncle. 4, 5, 6, 7, 8, & 9, bracteoles removed in ascending order from the branchlet. 10, flower bud. 11, 12, & 13, outer sepals. 14 & 15, inner sepals. 16 & 17, petal from mature bud. 18 & 19, stamens. 20, ovary with 3 stamens remaining attached. 21 & 22, stigmas. 23 & 24, mature fruits. (Drawings of twig & flower parts based on For. Dept. Sar. 167; fruits on C.F. 30363). *Scale applies to* 1, 23, & 24 *only*.

Plate XXVIII. **Shorea scabrida** Sym. 1, flowering twig. 2, 3, & 4, outer sepals. 5, & 6, inner sepals. 7, flower bud. 8 & 9, petal. 10 & 11, stamens from young bud. 12, mature bud—sepals and petals removed. 13, ovary. 14, section through ovary. 15, stigma. (Drawings based on For. Dept. Sar. 171). *Scale applies to* 1 *only*.

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# THE TREE-FERNS OF THE MALAY PENINSULA

*By* R. E. Holttum

The tree-ferns of the Malay Peninsula all belong to the family Cyatheaceæ. Dicksoniaceæ is represented only by Cibotium, which, with its creeping stem, can hardly be called a tree-fern. *Dicksonia Blumei* occurs in Borneo and in Sumatra, but has not so far been found in the Peninsula. It is hardly likely to be found now, as fairly intensive collecting has been done in localities where it might be expected to occur. It is only during the past few years, however, that so widely distributed and conspicuous a fern as *Osmunda javanica* has been found in the Peninsula, so it is just possible we may still find *Dicksonia Blumei*, which can be as large and handsome as our largest Cyatheas.

In this paper I follow Copeland in including Alsophila and Hemitelia in Cyathea. It is quite clear that no natural separation of this group of ferns can be made on indusial characters, and to decide what other characters might be used as a basis of division would require the study of the genus Cyathea as a whole, a task which I cannot attempt. Of the genus Cyathea in the broad sense, sixteen species are here described as occurring in the Peninsula, and also a new variety of one of them (*C. latebrosa*). Of these species, one is described as new (*C. excavata*), and one (*C. ampla*) has not previously been reported. One (*C. obtusata*) is rather a dubious species, not adequately known, and two others (*C. obscura* and *C. Burbidgei*) ought possibly to be reduced to varieties. The status of all the species has been critically considered, and type specimens of almost all have been examined. Special attention has been given to *C. glabra*, a very variable species. The new combination *Cyathea gigantea* is made.

A comparative survey of all species of Cyathea in the Malayan region is certainly needed, but I cannot at present undertake that task; the number of species is very large, and for an effective survey the types of all would have to be examined. Many of the published descriptions are such that one cannot be reasonably sure of the identity of specimens from them; and indeed the best descriptions are hardly adequate when one is dealing with so great a number of species, which yet have all a very similar general aspect, and where considerable variation in one character or another may occur. One can find variable characters only by examining a number of specimens of the same species. I have therefore come to the conclusion that it is better in the first place to deal as adequately as possible with the Peninsula species, of which I have a considerable number

of specimens for examination, and almost all of which I know in the field. A careful description of these may be helpful to others working on this group; and for local use the collecting of the available information into one paper will be of value.

The large number of species in this family of ferns, which there is every reason to regard as relatively primitive, is very remarkable, and a study of their individual distribution would be instructive. Unfortunately, before this can be effectively undertaken, a full systematic survey (as above indicated) is necessary. It is fairly clear that a number of the species are of restricted distribution, and it is probable that most of these are confined to mountains, while the species that will tolerate lowland conditions are of wider distribution. The great wealth of species, and the variation which occurs in the widely distributed species, are indications that the family is still a vigorous one. An analysis of the family from a phylogenetic standpoint has never been attempted, and the great majority of the species have never been examined further than the barest external features such as are usually found in systematic descriptions. How much variation in soral development may occur is not known; a casual inspection suggests that there is not much, but a thorough examination might reveal some interesting points hitherto overlooked. My own impression is that the scales on the stipe-bases are likely to be the best single character for discrimination of phyletic relationships within the group, venation probably coming next.

Sixteen species probably represent less than 10% of the number of Cyatheas described as occurring in the Malayan region; and even allowing for a fair proportion of the latter being reduced, we still have a poor representation of the family as compared with Sumatra. This is no doubt largely due to the lack of high mountains in the Peninsula. In Sumatra there is a large area of good forest between 6,000 and 8,000 feet above sea level, a forest exceedingly rich in ferns of all kinds, whereas there is very little high forest in the Peninsula at a similar altitude. There may yet be a few more species of tree ferns still to be found in the Peninsula, but I think the number will not be greatly increased.

Tree ferns are not numerous and conspicuous objects in the landscape except in rather open places on the hills, especially near streams; and here the gregarious and conspicuous species is *C. contaminans*, which is the largest of all our tree ferns, with very massive erect trunks and large crowns of fronds. All the other species are smaller in stature. The other really common species is *C. latebrosa*,

which is quite abundant in low country and mountains alike, at least up to 4,000 feet. It has a more slender trunk than *C. contaminans* and does not usually grow in quite such exposed places. It is often found near streams in fairly open forest or in secondary growth, but not often in large numbers, so that it never gives massed effects like *C. contaminans*. *C. squamulata* is not uncommon in rather more moist and shady lowland forest; also *C. brunonis*, which is so small as hardly to be called a tree fern. Species which only occur in mountain forest are *C. recommutata*, *C. Kingii*, *C. excavata* and *C. obscura*. *C. glabra* is found both in lowland and mountain forest, and varies much in degree of incision of the pinnules; perhaps altitude and other environmental factors may be partly responsible for this varition. *C. gigantea* is only found in the extreme north of the Peninsula, and is there at the southern limit of its distribution. *C. tripinnata*, found on Pulau Tioman, but not yet on the mainland of the Peninsula, was first found in Luzon, and then North Borneo; Pulau Tioman is perhaps its most westerly position. On Mt. Kinabalu it is frequent and very massive in growth at about 5,000 feet altitude, so that it might quite possibly find a suitable home in the Peninsula.

It is not possible to give complete information about the distribution beyond the Peninsula of the species here concerned, as the published data are inadequate. The following summary is of a general nature only.

*C. latebrosa* is widely distributed from India throughout the Malayan region.

*C. squamulata*, *C. contaminans* and *C. glabra* have a wide distribution within the Malayan region.

*C. Brunonis* and *C. recommutata* are known to occur in Borneo and Sumatra.

*C. obscura* and *C. Kingii* are known to occur in Sumatra.

*C. alternans*, *C. Burbidgei*, *C. ampla* and *C. polypoda* are known to occur in Borneo.

*C. tripinnata* has been found in Luzon, British North Borneo and Pulau Tioman.

*C. glabra* is distributed from the Himalayas southwards to Penang.

*C. obtusata* and *C. excavata* are only known to occur in the Peninsula.

Of the last species, *C. obtusata* is apparently closely allied to *C. latebrosa*, but is incompletely known. *C. excavata* appears to be a very distinct species, and has so far been found only in the neighbourhood of Cameron's Highlands, on the Main Range.

The distinction of the commoner Peninsula species of Cyathea is not difficult. One has only to look at the base of the stipe to be able to recognise at a glance *C. contaminans*, *C. latebrosa* and *C. squamulata* (including its near allies *C. obscura* and *C. Burbidgei*). The presence or absence of thorns, the characters of the scales and the colour of the stipes are indeed always important in distinguishing species of Cyathea, and without the base of the stipe it is often difficult to be sure of a species. The abundance and character of scales and hairs on the rachises, costæ and costules are also important, and a rather high magnification, beyond the scope of the pocket lens, is necessary to distinguish clearly the smallest scales. As regards the lamina, characters of the base and apex may be useful, but for most purposes I find that the only safe method of comparison is between the largest pinnæ of full-size fronds. In some species, particularly *C. glabra* among those here described, the variation in cutting of the pinnules is considerable; in others, other characters may be variable, such as the indusium in *C. Brunonis*. Venation, texture, colour and characters of the paraphyses and indusium (if present) are also important.

In most cases, I have examined considerable numbers of specimens of each species, nearly all from within the Peninsula, but in some cases from a wider area. I have been led on the whole to a rather broad interpretation of the species, on account of the obviously considerable variation in some cases, notably in *C. glabra* and *C. squamulata*. If one could choose a few isolated specimens, it would be easy to make several species from each of these, but having regard to the whole range of variation, I cannot see where to draw lines of division. I am sure that environmental conditions have a good deal to do with characters of size and texture. I may add that I have myself examined nearly all the species concerned in the field, and some of them in cultivation.

Cyathea plants do not usually bear sporangia until they have reached their fully adult size of frond, but there are exceptions to this rule. It may occasionally happen that small simply pinnate fronds of young plants are fertile. I have seen this condition in *C. squamulata* and *C. obscura*. *C. parvifolia* Holttum, described before I realised that such a thing could occur, is an immature form, probably of *C. squamulata*. I believe that *C. bipinnatifida* Copel. (Phil. Journ. Sci. 56: 97. 1935) is a similar case.

The limitation of certain species to mountains may be due to the specialised conditions necessary for the development of their gametophytes. I have now in cultivation in Singapore, growing reasonably well, *C. contaminans*, *C.*

*recommutata* and *C. tripinnata,* none of which have ever been found in lowland localities, at least in the south of the Peninsula; it is therefore not because they cannot exist in the lowlands. The conditions for the germination of the spores and growth of prothallia are evidently more specialised than those necessary for the growth of the mature sporophytes. Similarly, *Platycerium grande,* not uncommon in the extreme north of the Peninsula, grows quite well in the Singapore Botanic Gardens but, though it must produce countless spores, no young plants of it have ever been found; the reason is probably climatic. Other species will grow well here when introduced as mature plants, but never have spores; among these is *Polypodium ellipticum.*

The descriptions in this paper are taken from specimens in the Singapore Herbarium, except where otherwise indicated. An attempt has been made to make them as comprehensive as possible.

The Peninsula specimens which I have examined are listed at the end of each description. Recent collections made by the staff of the Singapore Botanic Gardens are numbered in a series of *Singapore Field Numbers;* these are cited as *SFN* with the collector's name in brackets afterwards. Similarly, the Forest Department's collections are cited *Forest,* with the collector's name in brackets. Ridley had his own series of numbers, and so had the Federated Malay States Museums. For reference to other Collectors and localities, the reader is referred to Burkill's paper in this Bulletin, Vol. IV pp. 114–202 (1927).

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### Key to the Species described in this Paper

This key is intended primarily for the assistance of field workers, and the characters chiefly used in separating the main divisions of the key are those of the stipe-base; these are easily recognised in the field, and are also very distinctive. A key based chiefly or only on pinnæ would be much less certain of application.

The field worker is advised to look for and collect fronds which have just reached maturity, as old fronds often lose their scales. In some species (e.g. *C. excavata*) the scales fall very early, and it is necessary to look for them on unexpanded fronds. When the scales fall, they usually leave small raised bases, which give a roughness to the base of the stipe; in some species these rough bases are prolonged into short thorns. The important characters

of the scales can easily be distinguished with a pocket lens: those of the *C. squamulata* group have very short stiff hairs or setæ regularly arranged along their edges; the scales of *C. latebrosa* and others have smooth edges; and the scales of the *C. glabra* group are dark with thin pale edges. The characters of the small scales on the costæ (pinnule midribs), costulæ and veins can only be seen when more highly magnified.

The inclusion of *C. obtusata* under the heading "base of stipe shortly thorny" is conjectural, but in view of its agreement with *C. latebrosa* in other respects, one may reasonably expect an agreement in stipe characters also.

Pinnæ simple, subentire .. .. .. 1. *C. Brunonis*

Pinnæ pinnatifid, or pinnate at base only .. 2. *C. alternans*

Pinnæ pinnate or bipinnate—

Base of stipes strongly thorny, stipes glaucous (purple when old) .. .. 3. *C. contaminans*

Base of stipes shortly thorny, stipes not glaucous—

Pinnules pinnate over most of their length .. .. .. .. 4. *C. tripinnata*

Pinnules with at most lowest one or two segments free—

Sori with minute scale on inner side only .. .. .. .. 5. *C. latebrosa*

Sori with complete cup-shaped indusium, costæ very scaly beneath .. var. *indusiata*

Sori with large scale on inner side, costæ with very few scales beneath .. .. .. 6. *C. obtusata*

Base of stipes often rough when old, but not thorny—

Base of stipes subglabrous; below them a V-shaped row of large depressions in caudex .. .. .. 7. *C. excavata*

Base of stipes covered with a dense mass of medium brown scales, edges of scales with dark setæ—

Secondary rachises and costæ scaly but not hairy beneath—

Texture distinctly coriaceous, scales at base of stipe only 8. *C. polypoda*

Texture rather thin, scales throughout stipe—

Pinnæ to about 1.5 cm. wide—

Sori when mature distinct, not coalescing 9. *C. squamulata*

Sori when mature coalescing and filling pinnules almost completely .. 10. *C. obscura*

Pinnæ to 2.5 cm. wide .. 12. *C. ampla*

Secondary rachises and costæ very hairy beneath .. .. 11. *C. Burbidgei*
Base of stipes rather sparsely scaly, the scales very dark, with pale edges—
Base of stipes bearing a few small pinnæ .. .. .. 13. *C. recommutata*
Base of stipes without pinnæ—
Lobes of fertile pinnæ much narrower than sterile .. 14. *C. Kingii*
Lobes of fertile and sterile pinnæ similar—
Pinnules distinctly stalked, veins 3–5 pairs .. .. 15. *C. glabra*
Pinnules sessile, veins 5–6 pairs .. .. .. 16. *C. gigantea*

1. **Cyathea Brunonis** Wall. Hook. Spec. Fil. 1: 15. 1844. *Schizocaena Brunonis* J. Sm. Hook. & Bauer Gen. Fil. t. II. 1838.

*Stock* usually short, occassionally 50 cm. or more high. *Stipes* rather dark, slightly roughened when scales have fallen, with numerous scales at the base; *scales* to about 3 cm. long by 3 mm. broad, medium brown, the edges with short oblique dark setæ. *Fronds* pinnate, the apical pinna usually like the others, and all pinnæ articulate to the rachis. *Pinnae* sessile or on stalks to about 4 mm. long (occasionally to 7 mm.), 12 to 28 cm. long and 2 to 4 cm. wide, the base rather unequally cuneate or truncate, the apex acuminate, the edges entire, toothed towards the apex, occasionally the edges somewhat lobed; the edges almost parallel for the greater part of their length, or converging gradually over half the length; *veins* in groups of 3 to 5, the basal one on the side towards the rachis often springing directly from the midrib of the pinna, occasionally a single simple vein about half-way between two groups; *scales* on lower surface of midribs of pinnæ, and occasionally also on veins, few, small, narrow, ciliate; *sori* in 2 or 3 irregular rows on each side of midribs of pinnæ, indusia thin, covering young sori, usually appearing cup-shaped in mature sori, sometimes forming only a narrow ring at the base of the sori; *paraphyses* dark, shorter than the sporangia.

TYPE: Penang, Wallich 179.

In Christensen's *Index Filicum* the species *C. Brunonis* is referred to *C. moluccana* R. Br. (an earlier name). I have not seen the type of the latter species, which came from the Moluccas. In view of the fact that there are a group of species of simply pinnate habit, it is quite likely that Peninsula and Molucca plants are different, and I prefer to use the name *C. Brunonis*, the type of which is from the Peninsula, pending further evidence of the status of *C. moluccana*.

I have examined the type of *C. Brunonis*, in the Kew Herbarium. The upper pinnæ are sessile, the lower stalked; the indusia are fully developed; there is a single vein between the groups; the apical pinna is like the rest.

Several closely allied species have been described from Borneo, but in view of the undoubtedly considerable variation of *C. Brunonis* in the Peninsula it appears probable that these species (except *C. capitata*, which is very distinct) will have to be reduced in number when fuller collections are available. Without examination of representative collections of ferns of this alliance over a wide area, it is not possible to say exactly what is the range of *C. Brunonis*.

PENANG: Wallich 179 (Type, at Kew). Bishop Hose, s.n. April 1879; Top of hill, Ridley 7036.

KELANTAN: Batu Panjang, S. Keteh, SFN 12091. (Md Nur).

PAHANG: Tahan River, Ridley s.n. 1891; Wray's Camp, G. Tahan, Ridley 16214; G. Tahan 3,300 feet Wray & Robinson 5379; Teku, G. Tahan, SFN 8038 (Haniff & Nur); near Kota Glanggi S.F.N. 22508 (Henderson); The Gap, 3,000 feet SFN 8826, 11399 (Holttum).

PERAK: near Taiping 1,000 feet Scortechini 239; Gopeng, King's Coll. 475; Larut 300–1,000 feet King's Coll. 4885; Bidor near Tapah Ridley s.n.; Maxwell's Hill 2,500 feet SFN 13217 (Burkill); Taiping hill 1,000 feet F.M.S. Mus. 10201 (Henderson), 600 feet F.M.S. Mus. 10098 (Henderson).

SELANGOR: Kuala Lumpur, Native Coll. 3540 (Ridley); Ginting Sempah F.M.S. Mus. 9547, 9548, 9562, 9793 (Hume); Rantau Panjang F.M.S. Mus. 7617, 7673 (Hume); Semenyih F.M.S. Mus. 7889 (Hume); Sungei Buloh F.R. Forest 13907, 14610 (Strugnell); Sungei Lalang, Kajang, Forest 22813 (Symington).

NEGRI SEMBILAN: Sungei Ujong, Hullett s.n. Aug. 1880; Bukit Kayu Arang, Alvins s.n. Jan. 1894; Perhentian Tinggi, Ridley s.n. Dec. 1898; G. Angsi 1,500 feet SFN 11535, 1,000 feet SFN 11519 (Md. Nur).

JOHORE: Woods, Batu Pahat, Ridley 11061; 7th mile from Kluang SFN 9263 (Holttum).

MALACCA: Cuming 378; Sungei Udang Reserve, Derry 92; Bukit Bruang, Ridley s.n. Apr. 1891; Jasin to Chabau, Ridley s.n. 1892; Bukit Toongull Ridley 4403.

2. **Cyathea alternans** (Wall.) Pr. Abh. Bohm. Ges. V. 5: 347. 1848. *Polypodium* Wall. Cat. (nomen).

*Stipes* dark, scaly at the base, the scales to 3 cm. long by 2 mm. wide, dark brown, the edges with short oblique setæ. *Rachises* dark to medium brown, almost glabrous below, appressed hairy above. *Middle pinnae* to about 40 by 9 cm., more often about 25 by 5 cm.; lowest pinnule (or a few pinnules) free, sessile, others with the lamina more and more broadly joined to the costa; distal part of pinnæ (almost the whole pinnæ of smallest fronds) lobed about ¾ to costa, the segments or pinnules about 7 to 8 mm. wide, entire or the largest crenate or toothed towards the apex, slightly oblique, slightly or hardly falcate, the apex rounded or in the largest fronds sometimes acute, usually very close, sometimes slightly overlapping; *veins* in each lobe or pinnule about 10 pairs or more, forked or the basal ones often more copiously branched; on costæ and veins beneath are a few *hairs* and also narrow to ovate acuminate usually pale *scales* with setose edges; *sori* in a single row on each side of costæ, rather nearer costæ than edge, indusium a thin cup, sometimes reduced to a narrow ring at the base of the sorus; *paraphyses* numerous, hardly exceeding the sporangia.

TYPE: Wallich 329, Penang.

This is a fern of lowland forest, not known in the extreme south of the Peninsula, and apparently rather local in its occurrence. In some places, as on parts of Penang Hill, it is fairly abundant. I have never seen a plant with a trunk more than 1.50 m. high. The species also occurs in Borneo. A collection from Mt. Kinabalu (Clemens 29160) appears to be quite without indusium.

PENANG: Hullett s.n. Dec. 1881; Curtis 10139; Government Hill, Road to Penara Bukit, Curtis s.n. Oct. 1898, Ridley 7152; Penara Bukit, Ridley 7151; Penang Hill 2,000 feet SFN 19341 (Holttum).

PERAK: G. Bubu, Cantley s.n. Jan. 1885.

KELANTAN: Ulu Sungei Keteh SFN. 12269 (Md. Nur).
SELANGOR: Kuala Lumpur Ridley 10173; Petaling 10 mile, Ridley s.n. June 1889; Ginting Sempah F.M.S. Mus. 9635 (Hume).

NEGRI SEMBILAN: G. Angsi 2,600 feet SFN 11635 (Md. Nur): G. Angsi, SFN 9919 (Holttum).

3. **Cyathea contaminans** (Wall.) Copel. Phil. Journ. Sci. 4C: 60. 1909. *Polypodium contaminans* Wall. Cat. (nomen); *Alsophila* Hk. Spec. Fil. 1: 52. 1844. *Chnoophora glauca* Bl. (not *Cyathea glauca* Bory).

*Stipes* stout, strongly thorny, purplish, glaucous, glabrous when mature; very young stipes clothed with pale narrow scales with dark short setæ on edges. *Rachises* as stipes, the upper parts less strongly thorny, but even secondary rachises somewhat prickly, hairy on the upper surface. *Middle pinnae* to about 60 cm. long by 25 cm. wide. *Pinnules* of middle pinnæ to about 15 by 2 to 3 cm., sessile, the base truncate, the apex acuminate, the edges lobed almost to the costæ, the basal lobe free; lobes about 3 mm. wide, slightly oblique and slightly falcate, edge entire or slightly crenulate, apex rounded; *veins* about 10 to 12 pairs, forked or the basal ones with 3 branches; *texture* thin but firm; lower surface glaucous; costæ, costules and veins beneath quite glabrous, or occassionally with a few hairs or a few pale bullate fimbriate scales; *sori* near costules; no indusia; short *paraphyses* present among the sporangia, those at the base forming a ring somewhat resembling an indusium.

TYPE: Penang, Wallich 320.

This is the common tree fern on the hills, growing especially in open places and by streams. It is the largest of all the tree ferns in the Peninsula, in thickness and height of trunk and in size of fronds. It is widely distributed in the Malayan region.

PENANG: Penang Hill 1,000 feet June 1885 coll.?; Hullett s.n. Dec. 1880; 2,500 feet King's Coll. 1280.

KEDAH: G. Raya, Langkawi, 2,500 feet Haniff 15543.

KELANTAN: Kuala Bedong SFN 10393 (Haniff & Nur).

PERAK: Scortechini, no locality, several sheets; Lumut, Ridley 7272 (young plant); Cottage, Ridley s.n. (small plant, fasciated frond); Larut 300–800 feet King's Coll. 4032. G. Hijau, summit, 4,750 feet SFN 12883 (Burkill).

PAHANG: P. Tioman; Bukit Surin, 1,000–2,000 feet SFN 21711 (Henderson), Tanah Runto 1,300 feet SFN 18871 (Henderson), Path across island 1,100 feet Burkill s.n. June 1915. Fraser's Hill 4,000 feet SFN 8812 (Burkill & Holttum).

SELANGOR: 15th mile Pahang Track, Ridley 8633; Ginting Bidai, Ridley 7868; Ampang Reservoir, Forest 13984 (Strugnell).

JOHORE: Bukit Soga, Ridley 11066.

4. **Cyathea tripinnata** Copeland, Phil. Journ. Sci. Suppl. 1 p. 251. 1906.

*Stipe* dark, copiously short-thorny, the thorns about 2 mm. long, covered with a dense mat of small closely

**Cyathea latebrosa.** Two plants from Penang Hill: (above on left) Haniff 9109, (right) Hullett, Dec. 1881, × 1.25.

appressed scales, the smallest ones pale irregular, the larger ones lanceolate with dark acuminate tip, stiffly ciliate laterally or not. *Rachises* dark, shortly thorny (including the secondary rachises), with short appressed hairs on the upper surface, on the lower surface dense closely appressed irregular pale scales and larger medium brown scales with dark setose edge towards tip, the larger scales not appressed. *Middle pinnae* to about 60 by 18 cm. *Pinnules* of middle pinnæ to about 9 by 2 cm., on stalks 2 to 3 mm. long, base slightly unequal, apex shortly pointed, about 10 pairs of segments free and stalked, gradually grading into sessile ones; the *free segments* about 2.5 mm. wide, on stalks about 1 mm. long, base slightly unequal, truncate to subcordate, of basal segments slightly broadened, apex blunt, edges crenate (basal segment with basal lobe sometimes almost free), almost at right angles to costæ, the higher ones somewhat oblique; *veins* about 9 pairs, mostly forked, distinct; *texture* thin but firm; *scales* on costæ beneath as on the rachises, scales on the costules rather pale with edges towards apex dark-setose, grading into pale bullate scales, fairly numerous; *sori* subcostular, indusia of the old sori thin, irregular.

TYPE: Mt. Mariveles, Luzon, Copeland 2068.

This species has not yet been found on the mainland of the Peninsula, but occurs on Pulau Tioman, the largest of the adjacent islands in the China sea. It has been found on Mt. Kinabalu in British North Borneo, where it is a very massive plant; the Pulau Tioman specimens are rather smaller, and were found at a much lower altitude.

PULAU TIOMAN: Bukit Telang, 800 feet, SFN 18584 (Henderson); Sedagong, 800 feet, a young plant, SFN 18617 (Henderson).

5. **Cyathea latebrosa** (Wall.) Copel. Phil. Journ. Sci. 4C: 52. 1909. *Alsophila latebrosa* Wall. Hook. Spec. Fil. 1: 37. 1844. *Alsophila brevifoliolata* v.A.v.R. Bull. Jard. bot. Buitenz. II ser. XX: 3. 1915. **Plate 29.**

*Stipe* dark, the base spiny, the spines numerous short stout; *scales* few except on young fronds, dark, rather narrow and thick, edge entire. *Rachises* dark to medium brown, subglabrous below, hairy above. *Middle pinnae* to about 60 by 20 cm. *Pinnules* of middle pinnæ to about 11 by 1.5 cm., sessile or very shortly stalked, base broadly cuneate, slightly unequal, apex gradually narrowed, acuminate, or sometimes more shortly pointed, lobed to about 1 mm. from costa, lobes separated by 1/4 to 3/4 of their own width, 2.5 to 3 mm. wide, slightly oblique, slightly to moderately falcate, the apex rounded, edges slightly crenulate to sharply

toothed; *veins* about 10 pairs, mostly forked, all springing from the costule, slightly prominent below but not above; *texture* thin; *colour* varying from dark to pale, more usually dark; *scales* on costæ beneath lanceolate to ovate acute, edges entire, thin, medium brown to pale, sometimes quite abundant, sometimes few; scales on costules ovate flat to bullate, pale, entire, varying in abundance but never very numerous; *sori* close to costules, sometimes very crowded, the indusium a small dark scale on the inner side; *paraphyses* brownish, shorter than sporangia.

TYPE: Penang, Wallich 318.

This is the common tree-fern throughout the lowlands of the Peninsula; it occurs also on the mountains up to 4,000 feet or more. Ridley and Beddome give the name var. *ornata* to a form with pinnules up to 3 cm. wide, the segments deeply toothed and widely separated. This grades into the typical form, and in my opinion should not be separated. It is probably not the same as *Cyathea ornata* (Scott) Copel. from Sikkim. Possibly *C. inciso-serrata* Copel. is the same as Ridley's var. *ornata*.

I have seen at Kew a specimen of the type collection of *A. brevifoliolata* v.A.v.R., and in my opinion it is only a small plant of this species.

KEDAH: Langkawi Islands: Curtis s.n. Sept. 1890; G. Raya, SFN 7127 (Haniff & Nur). G. Jerai (Kedah Peak): 2,500–3,000 feet, Evans & Gordon 108; Native Coll. 4183, 4699. Gurun, Native Coll. 5163; Yan, Ridley 5177.

PENANG: Hullett s.n. Dec. 1881; Ridley 7080, 12599; Curtis 537, 3074, 10141; Top of Hill, Ridley 7150; Western Hill, 2,500 feet, SFN 9109 (Haniff).

PROVINCE WELLESLEY: Tasek Gelugur, Ridley 6965.

PERAK: Larut 3–4,000 feet, King's Coll. 2359; 4,500–5,300 feet, King's Coll. 7317. Kinta, 1,500–2,000 feet, King's Coll. 7154. Maxwell's Hill 3,000 feet, Scortechini 222,223. Taiping, Curtis 10134. G. Hijau, Fox s.n. Oct. 1899. Waterfall Hill, Taiping, Ridley 3060. Bujong Malacca, Ridley 9551. G. Keledang, Ridley 9548. Temengoh, Ridley 14207. Taiping Hill; 600 feet F.M.S. Mus. 10258, 1,400 feet F.M.S. Mus. 10198 (Henderson). Jor Camp, 1,800 feet F.M.S. Mus. 10802 (Henderson). Dindings: Lumut, Ridley 10295.

KELANTAN: Kuala Pertang, SFN 10367 (Haniff & Nur). Foot of G. Stong, SFN 12266 (Md. Nur). S. Keteh at Gua Ninek, SFN 19579 (Henderson).

PAHANG: Fraser's Hill, 4,000 feet: SFN 8794, 8825 (Burkill & Holttum); Eryl Smith 814, 901. Teku, G. Tahan, SFN 8040 (Haniff & Nur). Ulu Chineras, K. Lipis,

SFN 15683 (Burkill). Pekan, SFN 17124 (Burkill). G. Gedong (Tahan), 5,000 feet, Holttum s.n. Sept. 1928.

SELANGOR: Bukit Kutu, Ridley 7865, 7866. 15th mile Pahang Track, Ridley 8663. Batang Berjuntai, Ridley 7879 (or 7870 ?). Dusun Tua, Ridley 7862; Jackson's Estate, Gua Batu, Ridley 8141. Klang Gates, Ridley 13439. Rantau Panjang F.R., F.M.S. Mus. 7629 (Hume). Ginting Simpah 1,800 feet, F.M.S. Mus. 8797 (Hume). Kajang, Forest 24107 (Symington).

NEGRI SEMBILAN: Sungei Ujong, Hullett s.n. Aug. 1880. G. Angsi 1,000 feet, SFN 11523 (Md. Nur).

MALACCA: Ayer Keroh, Ridley 10785. Ayer Panas, Ridley 1659.

JOHORE: Tanjong Kupang, Ridley 6551 (var. *ornata*), 4400. Batu Pahat, Ridley 10981, 11068. Haji Senawi, Ridley 10966. G. Panti, Ridley s.n. Dec. 1892. Temoh River, Kota Tinggi, Ridley 15969. Tempayan River, Ridley 13279. Kluang SFN 9352, 9450, 9452 (Holttum). G. Pulai, SFN 7839 (Best).

SINGAPORE: Bukit Timah, Cantley s.n. July 1885. Ang Mo Kio, Ridley 6550. S. Morei, Ridley 6552. Chua Chu Kang, Ridley 6029. Chan Chu Kang, Ridley 6123. Macpherson Road, Ridley 8936. Bukit Panjang, Ridley 12535.

**Cyathea latebrosa** (Wall.) Copel. var. **indusiata** Holttum var. nov.

A typo differt: costulis dense squamulatis, soris indusiatis, indusiis cupuliformibus.

So far as I can see, this fern is quite identical with typical *C. latebrosa* except for the two points mentioned in the above diagnosis. The costæ of var. *indusiata* are very scaly instead of sparsely scaly, but the scales are identical. The indusia are thin and cup-shaped in mature sori, equally wide all round, or deeper on the costular side. *Cyathea longipinna* Copel. seems to be exactly like var. *indusiata* in scaliness, but without the large indusia; I would include it also as a variety of *C. latebrosa*. It is possible that *C. latebrosa* var. *indusiata* has already been described, but it is not among the many species I have examined, nor can I find it among the descriptions which I have consulted.

This variety seems to be a mountain plant in the Peninsula. It has been found at two localities on the Main Range at 4,000 and 5,000 feet, and on the summit of Gunong Muntahak in Johore. Owing to its similarity to typical *C. latebrosa*, it may have been neglected by collectors.

PAHANG: Cameron's Highlands, Path to Telom, 5,000 feet, SFN 23539 (Holttum). Fraser's Hill, 4,000 feet: F.M.S. Mus. 11315 (Henderson), SFN 11005 (Md. Nur).

JOHORE: G. Muntahak, 2,000 feet, SFN 19910 (Holttum).

6. **Cyathea obtusata** Rosenstock, Med.'s Rijks Herb. Leiden 31: 1. 1917. **Plate 30.**

*Stipes* unknown. *Rachises* pale, subglabrous below, appressed hairy above. *Middle pinnae* to 50 by 18 cm. *Pinnules* of middle pinnæ 6 to 9 by 1.5 to 2.2 cm., sessile or the lowest slightly stalked, base truncate slightly unequal, apex shortly acute, lobed almost to costa; *lobes* very close together, 2.5 to 3.5 mm. wide, slightly oblique and slightly falcate, the apex rounded and very slightly toothed; *veins* about 7 to 10 pairs, mostly forked, all springing from costules; *texture* thin; colour of both surfaces rather pale when dry; *scales* on costæ beneath very few, on costules bullate, dark, not numerous, all entire; *sori* close to costules, indusia rather large, thin, irregular, flattened, usually broadest on the costular side.

TYPE: Perak, King's Coll. 7148 (cited erroneously as 1148).

This species appears to be closely allied to C. latebrosa. The differences are the pale colour of the specimens and the presence of indusia. If the indusia were absent, I should refer them to *C. latebrosa;* the pale colour might be due to the preparation of the specimens. It is likely that they may eventually be regarded as a variety of *C. latebrosa,* comparable with var. *indusiata,* but with few scales.

PERAK: Near G.M., 2,000 to 2,500 feet, King's Coll. 7148. Scortechini, no locality.

SELANGOR: Kajang, Forest 22874 (Symington); a doubtful specimen.

7. **Cyathea excavata** Holttum sp. nov. **Plate 31.**

*Caudex* sub stipitibus pneumatophoris magnis, profunde excavatis, c. 15, figura V instructis, præditus; pneumatophora stipitum distantiora, elongata, leviter excavata. *Stipites* in vivo virides, adulti fere glabri, frondium juvenilium circinatarum squamulati; squamæ fuscæ, non nitidæ, tenues, integræ. *Rachides* in vivo virides, in sicco pallidæ, infra glabræ, supra pilosæ. *Pinnae mediae* c. 50 cm. longæ, 16 cm. latæ; pinnæ infimæ reductæ. *Pinnulae* pinnarum mediarum c. 8 cm. longæ, 1.8 cm. latæ, sessiles vel brevissime stipitatæ, basi inæquale, truncata, apice breviter acuto, marginibus fere ad costam lobatis; *lobi* intervallis latitudini

**Cyathea obtusata.** King's Collector 7148, × 1.25.

**Cyathea excavata.** Holttum 23538, × 1.25.

**Cyathea polypoda.** King's Collector 7129, × 1.25.

suæ paribus collocati, c. 2.5 mm. lati, leviter obliqui, leviter falcati, apice rotundato, marginibus integris; *venulae* c. 10–12–jugatæ, plerumque furcatæ; *textura* tenuis; lamina supra et subtus glabra; *squamulae* costarum et costularum paucæ, tenues, applanatæ, irregulares, brunneæ vel pallidæ; *sori* ut videtur pauci, prope costam, in venulis infimis sedentes; indusia sororum senilium tenuia irregularia, late aperta.

PAHANG: Cameron's Highlands, 5,000 feet, SFN 23538 (Holttum, TYPE); Cameron's Highlands, 4,800 feet, SFN 17802 (Henderson). Telom, Ridley 13932.

This very distinct species has so far only been found in the neighbourhood of Cameron's Highlands. Fully fertile fronds are much to be desired; those so far obtained are only very sparsely fertile with old sori only. The deeply excavated pneumatophores at the base of each frond are a very striking feature in the field, but are not likely to be well represented in herbarium specimens; the thin entire sparse scales are also distinctive.

8. **Cyathea polypoda** Baker Trans. Linn. Soc. II Bot. 4: 250. 1894. *C. kemberangana* Copel. Phil. Journ. Sci. 12C: 52. 1917. **Plate 32.**

*Stipe* pale to medium brown, the base darkened and roughened; no scales on material from Malay Peninsula, but on Kinabalu specimens base of stipe densely clothed for a short distance with pale scales, the edges shortly dark-setose. *Rachises* smooth and pale beneath, with pale stiff appressed hairs above. *Largest pinnae* to about 40 by 16 cm. *Pinnules* to about 8.5 by 2 cm., on stalks 1 to 6 mm. long, articulated at base, the base truncate and slightly unequal, the apex rather shortly pointed, the edge lobed 2/3 or occasionally 3/4 to the costa, the lowest lobes the deepest and sometimes the lowest basal segment nearly free; the lobes 4 to 5 mm. wide, slightly oblique, slightly falcate, rounded at apex, edges slightly toothed; *texture* decidedly coriaceous; *veins* up to about 7 pairs, on the larger segments usually several pairs forked, lowest basiscopic vein springing directly from the costa. Upper surface usually drying dark, lower pale. *Scales* on costæ and costules below linear-lanceolate, stiff, medium brown, shining, the edges provided with stiff setæ; scales on costules bullate. Costæ and costules hairy above like the rachises. *Sori* medial, exindusiate, with dark paraphyses about equal in length to sporangia, or a little longer.

TYPE: Kinabalu, Haviland 1479, at Kew.

I have examined the type of this species. It is a single pinna of a young frond. Indusia are lacking, although Baker states that small indusia are present. The form,

venation and scales are in exact agreement with specimens collected by me on Kinabalu and stated by Christensen to agree with *C. kemberangana* Copel. The Peninsula specimens are rather smaller than those from Kinabalu, but are otherwise identical. This species is clearly allied to *C. squamulata*, differing in the distinctly coriaceous texture, less falcate pinnule-lobes, longer pinnule-stalks and in the relatively small number of scales at the base of the stipe; the rather short brown paraphyses also distinguish it from most specimens of *C. squamulata*, but there are exceptions to this (*see* remarks under *C. squamulata*). *C. polypoda* is evidently a fern of exposed mountain tops and ridges, as opposed to the rather shade-loving and usually lowland *C. squamulata.*

JOHORE: Mt. Ophir: Padang Batu, Ridley 9857; Top, Ridley 865; Hullett s.n. Dec. 1883. G. Bĕlumut 3,300 feet, SFN 10741, 10690 (Holttum).

PERAK: Near top of G.M. 3,500–4,000 feet, King's Coll. 7129, 7229.

9. **Cyathea squamulata** (Bl.) Copel. Phil. Journ. Sci. 4C: 37. 1909. *Gymnosphaera squamulata* Bl. Enum. 243. 1823. *Alsophila comosa* Wall. Hook. Spec. Fil. 1: 53, t. 20A. 1844. *Alsophila Ridleyi* Bak. Ann. Bot. 8: 122. 1894. *Cyathea Ridleyi* Copel. Phil. Journ. Sci. 4C: 36. 1909. *C. elliptica* Copel. Phil. Journ. Sci. 12C: 51. 1917. *C. paraphysata* Copel. Phil. Journ. Sci. 6C: 135, t. XV. 1911. *Cyathea Brooksii* Copel. Phil. Journ. Sci. 6C: 135, t. XVI. 1911. *Alsophila sarawakensis* C. Chr. Ind. Fil. Suppl. *Cyathea deuterobrooksii* Copel. Phil. Journ. Sci. 38: 131. 1929. **Plate 33.**

*Stipes* dark to medium brown, densely scaly at base, scales on lower side broader and more spreading, on upper side narrower and more appressed; largest scales about 3 cm. long by 2 mm. wide, medium brown, the edges minutely dark-setose. *Rachises* medium brown, with appressed hairs above, sparsely scaly below with minute strongly setose scales. *Middle pinnae* to about 50 by 20 cm., more usually about 15 cm. wide. *Pinnules* of middle pinnæ to about 10 by 2 cm. (usually about 8 by 1.6 cm), on stalks 1 to 2 mm. long, the base unequal truncate, the apex rather shortly acute, lobes cut 2/3 or sometimes 3/4 to the costa; *lobes* 3 to 4 mm. wide, slightly oblique, midrib strongly falcate towards apex of lobe, sides parallel, the lower one curved over at apex, apex bluntly pointed, entire or slightly toothed; *veins* about 6 pairs, basal ones usually forked, basal vein on side towards pinna-rachis springing

**Cyathea squamulata.** Two plants from Penang Hill: (left) Haniff 9123, (right) Ridley 7107, × 1.25.

directly from the costa; texture thin; colour usually dark above and paler below; surfaces and veins glabrous except for occasional hairs on veins on upper surface; *scales* on costæ and costules below not very numerous, on costæ lanceolate with or without paler slightly bullate base, the edges strongly setose, gradually transitional to pale bullate scales with darker setose tips on the costules; *sori* median on the veins, distinct from each other at maturity, not occupying the whole surface, paraphyses long pale numerous, longer than the sporangia.

TYPE: Java, in Blume's Herbarium.

The typical form of this species, from Java, has rather pale paraphyses which are only a little longer than the sporangia. I have seen a considerable number of sheets from Java, and all agree in this character, which was noted by Mettenius (Ann. Lugd. Bat. 1: 52). In characters of size, texture, venation, width and cutting of pinnules, there is much variation in the Java specimens. They tend however to be more coriaceous than the Peninsula plants; this is perhaps due to their being mostly mountain plants whereas Peninsula specimens are mostly from shady lowland forest. Some of the Java specimens match typical Peninsula specimens except for the paraphyses.

Peninsula plants nearly all have long pale paraphyses, much longer than the sporangia. The additional length is due to additional elongation of the cells. A few specimens from Penang have rather dark brown paraphyses (not very easy to observe), about as long as the sporangia. These specimens vary in size and cutting of pinnules in exactly the same way as the specimens with long pale paraphyses; specimens with long paraphyses can be found to match exactly in all other characters those with short paraphyses. It appears to me therefore that all forms must be included in one species.

There is one specimen from Gunong Panti, Johore (Ridley 4150) which has short dark paraphyses and rather long-stalked lower pinnules, somewhat intermediate between *C. squamulata* and *C. polypoda*. In texture however it is very different from *C. polypoda*, and the segments are distinctly falcate.

The size of the pinnules of *C. squamulata* varies much in different pinnæ of the same frond, and in smaller and larger plants growing side by side. The venation (number of veins and whether simple or forked) also varies considerably in different parts of the same frond. *Alsophila Ridleyi* Bak. was based on a small plant.

As normally found in the Peninsula, the species is easily distinguished by the densely scaly stipe (the scales thin and with minutely setose edges) and the pinnules cut not more than 2/3 to the costa. *C. Burbidgei* agrees in scaliness, but has densely hairy rachis and costæ beneath. In Singapore and the south of Johore *C. squamulata* is a fairly common plant near streams in forest. It has also been found in Penang, but not in the intervening parts of the Peninsula, from which further collections are needed.

The reduction of *C. elliptica* Copel. is due to Christensen (this Bulletin, Vol. VII, p. 219). I have seen specimens of the type collections of *C. Brooksii* Copel. and *C. paraphysata* Copel.; both appear to me to fall within the range of variation of this species. I have also seen the type of *Alsophila comosa* Wall.

PENANG: Without locality: Hullett s.n. Dec. 1881; Ridley 7040, 7076; Curtis 538, 10140; Bishop Hose s.n. June 1896. Penang Hill, Ridley 7017. Road to Penara Bukit, Curtis s.n. Oct. 1898. Above Ayer Itam, 1,000 feet, SFN 19339 (Holttum).

JOHORE: G. Panti, Ridley 4150 (paraphyses short dark). Mt. Austin, Ridley 12571. Sedenak, Ridley 13475. Pelepah Valley, SFN 24504 (Holttum).

SINGAPORE: S. Morai, Ridley 4401 (type of *A. Ridleyi*). Chan Chu Kang, Ridley 4398, 6122. Chua Chu Kang, Ridley 6031, also s.n. May 1905. Bukit Mandai, Ridley 4402. Bukit Panjang, Ridley 12537, 13313. Bukit Timah, Ridley 12557, 6549, Matthew s.n. Jurong, Ridley 5756. No locality, Cantley s.n. Aug. 1881.

WITHOUT LOCALITY: King's Coll. 186.

10. **Cyathea obscura** (Scort.) Copel. Phil. Journ. Sci. 4C: 37. 1909. *Alsophila obscura* Scort. Bedd. Journ. Bot. 25: 321, pl. 278, f. 2. 1887. *A. subobscura* v.A.v.R. Bull. Jard. bot. Buitenz. II ser. XX: 1, t. 1. 1915. **Plate 34.**

*Stipes* dark (not black) to medium brown, densely scaly at base, the scales to about 3 cm. long by 2 mm. broad, medium brown, the edges shortly dark ciliate. *Rachises* medium brown with appressed hairs above and minute strongly setose scales beneath. *Middle pinnae* to about 50 by 15 cm. *Pinnules* of middle pinnæ to about 8 by 1.5 cm., on stalks 1 to 2 mm. long, the base unequal and more or less truncate, the apex acute, rather shortly narrowed; *lobes* cut about 1/2 to 2/3 to costæ, about 3 mm. wide, slightly oblique, sides parallel, falcate at apex, apex bluntly pointed; *veins* about 6 pairs lowest usually forked, basal vein on side towards pinna-rachis springing directly from the costa; *texture* firm; colour dark above and paler beneath; surfaces

**Cyathea obscura.** Fraser's Hill, Holttum 21540, × 1.25.

and veins glabrous; scales on costæ few except at base, lanceolate, brown with or without paler bullate base, edges setose, bullate scales on costules pale with dark setose apex; *sori* median on basal veins, becoming very crowded when mature, filling the whole surface except tips of lobes, the sporangia mixed with long pale paraphyses; no indusia.

TYPE: Perak, Scortechini.

The type of this species is presumably in Beddome's herbarium, and I have not seen it. At Singapore however there are specimens from Scortechini's herbarium labelled *A. obscura*, and also duplicates of Kunstler's collections named by Beddome. All these agree very well together, and I have little doubt that they represent this species. *C. obscura* is fairly common on the Main Range and the Taiping Hills at about 3,000 to 4,000 feet altitude. Specimens from Penang are rather intermediate between typical *C. obscura* and *C. squamulata*, and it may be that *C. obscura* should be regarded only as a variety of *C. squamulata*, differing in firmer texture, the pinnules never so deeply cut as in the largest plants of *C. squamulata*, and especially in the spreading of the sporangia to cover the whole lower surface of the pinnules. As in *C. squamulata*, young plants with only pinnate fronds may occasionally be fertile. I have seen two specimens of the type collection of *A. subobscura*, from Sumatra, and consider them identical with *A. obscura*.

PENANG: Road to Penara Bukit, Ridley 7153.

PERAK: Scortechini, s.n., 5 sheets. Larut, 3,500–4,000 feet, King's Coll. 6391. Larut, 3,000 feet, Bishop Hose s.n. March 1893. G. Hijau, W. Fox s.n. Octo. 1879. Maxwell's Hill: Ridley 5185, Curtis 2692, Anderson 140, SFN 12534 (Burkill; young plant).

PAHANG: Telom, Ridley 13930. Cameron's Highlands: Robinson's Falls, 4,400 feet, SFN 23453 (Holttum); Top of Falls, SFN 17760 (Henderson; sterile specimen); Fraser's Hill: 4,000 feet, SFN 8779, 8796 (Burkill & Holttum), 21540 (Holttum).

11. **Cyathea Burbidgei** (Bak.) Copel. Phil. Journ. Sci. 4C: 55. 1909. *Alsophila Burbidgei* Bak. Journ. Bot. 1879: 38. *Alsophila trichodesma* Scort. Bedd. Journ. Bot. 25: 321. 1887. *Cyathea mollis* Copel. Phil. Journ. Sci. 12C: 52. 1917. *C. poiensis* Copel. Phil. Journ. Sci. 6C: 362. 1911.

*Stipes* dark brown, roughened when scales have fallen, the base when young covered with numerous pale to medium brown scales; scales about 2.5 cm. long and 2 mm. broad, the edges with very short oblique dark setæ. Main *rachis*

dark, subglabrous below, smaller rachises covered with spreading hairs 2 to 3 mm. long on lower surface, and appressed hairs above. *Middle pinnae* to about 60 by 18 cm. *Pinnules* of middle pinnæ to about 11 by 1.5 cm., the higher ones sessile, the lower on stalks 2 to 3 mm. long, the base unequal, rounded, the apex shortly acuminate, the sides lobed 3/4 or more to the costæ, the basal segment often free; the *lobes* 3 to 4 mm. wide at their base, slightly oblique and gradually narrowed upwards, falcate, the apex subacute or rounded, subentire or slightly toothed; *veins* about 6 pairs, the lower ones forked, the basal one on side towards pinna-rachis springing directly from the costa; *texture* thin; colour rather pale; costæ, costules and veins below covered with spreading pale hairs; a few lanceolate pale scales, more or less bullate at their base, mixed with hairs on the costæ, pale bullate scales with setose apices on costules, not very abundant; *sori* median, no indusium; paraphyses numerous long pale, much exceeding the sporangia.

TYPE: Borneo, Burbidge.

Christensen has previously discussed this species (this Bulletin Vol. IV, p. 379). He has seen the type, and has identified with it some specimens from the Peninsula; also *C. mollis* Copel. I have examined the type number of *C. poiensis* Copel. in Brooks's Herbarium, and consider it to be a small plant of *C. Burbidgei.*

This species also is certainly closely allied to *C. squamulata,* and might possibly be regarded as a variety. It differs chiefly from typical *C. squamulata* in the extreme hairiness of the costæ, costules and veins beneath, and appears also to be usually a larger fern with more deeply lobed pinnules. Young plants of *C. squamulata* are somewhat hairy, and could hardly be distinguished from young plants of *C. Burbidgei. C. Burbidgei* seems to be a species of lowland forests and the lower slopes of mountains; curiously enough, it has only been found (with the exception of a doubtful specimen of a young plant from Penang) in the middle part of the Peninsula, from which specimens of *C. squamulata* are lacking.

PENANG: No loc. or date, Forest Guard (young plant).

PERAK: Bujong Malacca, Wray (?), s.n. Scortechini, no locality.

PAHANG: Kuala Teku, 500 feet, SFN 20096 (Holttum).

SELANGOR: Semenyih, F.M.S. Mus. 7917, 8712 (Hume, young plant). Kajang, Forest 22867, 22930 (Symington).

NEGRI SEMBILAN: G. Angsi, SFN 9889 (Holttum). Bukit Tangga, SFN 11830 (Md. Nur).

**Cyathea ampla.** Holttum 19883 (largest pinnule), × 1.25.

12. **Cyathea ampla** Copel. Phil. Journ. Sci. 6C: 361. 1911. **Plate 35.**

*Stipes* dark brown, slightly roughened when scales have fallen; scales at base of stipe very abundant, medium brown, to about 3 cm. long by 2 mm. broad, the edges with minute stiff dark oblique setæ. *Rachises* dark brown in basal parts, paler towards apex of frond, sparsely minutely scaly below, appressed hairy above. *Pinnae* distinctly articulted. Middle pinnæ to 60 by 22 cm. *Pinnules* of middle pinnæ to 11.5 by 2.7 cm., on stalks 6 to 8 mm. long, the base unequally cordate, the apex acuminate broadly toothed, the basal two segments on basal pinnules free, the rest cut 3/4 or more to the costa; *segments* 6 to 7 mm. wide at base, slightly oblique, slightly falcate (the lowest not falcate) the apex bluntly pointed, the edge shallowly toothed; *veins* 7 to 8 pairs, usually all forked except the highest, the basal one on the side towards the pinna-rachis springing directly from the costa, elevated on both surfaces, broader below and not darkened; *texture* firm; *scales* on base of costæ dark, narrow, with setose edge, mixed with very small scales of similar nature; scales at base of costules as on costæ, distal scales bullate, dark with setose tip, occasionally paler; *sori* nearer costules than edge, rather small and quite distinct; no indusia; paraphyses numerous pale, slightly exceeding the sporangia.

TYPE: Mt. Singgie, Sarawak, Brooks 106.

The above description is taken from the only specimens found in the Peninsula, namely SFN 19883, collected by me at 2,000 feet altitude (the summit) on G. Muntahak, Johore. I have compared these with the type number in Brooks's Herbarium, and believe them to be identical. The species is closely allied to *C. squamulata,* but decidedly larger in all its parts. The higher pinnæ of *C. ampla* would be difficult to distinguish from *C. squamulata.*

13. **Cyathea recommutata** Copeland Phil. Journ. Sci. 4C: 36. 1909. *Alsophila commutata* Mett. Ann. Lugd. Bat. 1: 53. 1863. *Cyathea Hewittii* Copel. Phil. Journ. Sci. 6C: 134, t. 14. 1911. *Alsophila heteromorpha* v.A.v.R. Bull. Jard. bot. Buitenz. II. ser. XVI: 1. 1914. *Cyathea Toppingii* Copel. Phil. Journ. Sci. 12C: 51. 1917.

*Stipes* very dark (nearly black), slightly roughened by bases of fallen scales; *scales* at base numerous, to about 2 cm. long by 2 mm. wide, dark with thin irregular margins, also scattered small thin pale scales; base of stipe bearing a few or several *reduced pinnae* 1.5 to 7.5 cm. long, 1 to 2 cm. wide, on stout stalks 1.5 to 2 cm. long, at right angles to stipe, pinnate at the base; the reduced pinnæ either in a small group at the base of the stipe only, or sometimes extending sparsely up to the normal pinnæ; reduced pinnæ

on old fronds spine-like owing to loss of leafy parts. *Rachises* sparsely minutely scaly below, appressed hairy above. *Middle pinnae* to about 40 by 15 cm., fertile pinnules contracted. *Fertile pinnules* 4 to 8 cm. long, 6 to 12 mm. wide, on stalks 2 to 3 mm. long, base truncate to cordate, apex acuminate, sides incised half-way to costa or a little more, lobes 3 to 4 mm. wide, oblique, bluntly acute, toothed; *sterile pinnules* about 9 by 1.8 cm., on stalks 2 mm. long, basal segment deeply cut, sometimes almost free, rest lobed about half-way to costa, lobes about 5 mm. wide, slightly oblique, apex rounded, slightly toothed, veins to about 7 pairs, simple, basal one not springing from costa; *scales* on costæ lanceolate, dark with pale edge, on costules paler, sub-bullate, edges irregular, not setose; *sori* subcostular, exindusiate, sometimes completely filling the surfaces of the fertile segments; *paraphyses* short dark not numerous.

TYPE: Malacca, Cuming 396.

The species *Alsophila commutata* Mett. was based on *Gymnosphaera squamulata* Hk., Gen. Fil. 100, which is a description and illustration of Cuming's fern from Malacca, wrongly identified with *G. squamulata* Bl. In transferring the species to Cyathea, Copeland had to make another new name, owing to the prior publication of *C. commutata* Spr.

I have examined specimens of the type collection of *C. Hewittii* and *A. heteromorpha;* they appear to me quite identical with this species. The reduction of *C. Toppingii* is due to Christensen (this Bulletin, 7: 220).

This is a small, rather slender tree fern of mountain forests. The type doubtless came from Mt. Ophir, where it has been collected again. It has also been found on the Main Range, Taiping Hills, and G. Tahan, while outside the Peninsula it is known from Sumatra and Borneo. On the whole, this species is not so variable in the cutting of the pinnules as some others, but there is a rather unusual specimen (Maxwell's Hill, Haniff 9085) which has large deeply incised pinnules; the sterile pinnules are up to 11 by 2.3 cm., fertile to 9.5 cm. long, the basal segments in both sometimes free and the other segments cut nearly to the costæ.

PERAK: Scortechini, without locality (2 sheets); Larut 1,800–2,000 feet, King's Coll. 1988; Larut, near G.M., 3,000–4,000 feet, King's Coll. 7130; Bujong Malacca, Ridley 9604; Maxwell's Hill 4,000 feet, SFN 9085 (Haniff).

PAHANG: G. Tahan: Wray's Camp, Ridley 16211; 3,000–3,500 feet, SFN 20572 (Holttum). Fraser's Hill, 4,000 feet, SFN 8793 (Holttum & Burkill), 11367, 21560 (Holttum).

**Cyathea Kingii.** Cameron's Highlands, Holttum 23537. Largest form of sterile pinnules; on right, a fertile pinnule, × 1.25.

SELANGOR: Bukit Hitam, Ridley 7869 (see Beddome in Kew Bull. 1902, p. 423).

JOHORE: Mt. Ophir: Ridley 3319; 3,500 feet, SFN 23705 (Holttum).

14. **Cyathea Kingii** (Clarke) Copeland, Phil. Journ. Sci. 4C: 56. 1909. *Alsophila Kingii* Clarke, Bedd. Handbook Addenda 475. 1883. **Plate 36.**

*Stipe* almost black, roughened at base, scales about 1 cm. long, 1 to 1.5 mm. broad, dark with pale thin edges. *Rachises* almost black or sometimes purplish, subglabrous below, dark-hairy above. *Middle pinnae* to about 75 by 20 cm., more often about 55 by 17 cm. *Fertile pinnules* much contracted, about 6–9 cm. long, 0.6 to 1.2 cm. wide, on stalks 1 to 3 mm. long, base truncate, apex shortly acute, basal segment on side towards main rachis sometimes free, rest of pinnule lobed almost to costa, segments about 3 mm. wide, slightly oblique, edges slightly toothed, veins about 6 pairs, usually simple, none springing direct from costa; *sterile pinnules* usually about 1.6 cm. wide, occasionally up to 2.5 cm., lobes with rounded apex and edge toothed towards apex, veins usually 6 to 8 pairs, mostly forked; occasionally several basal segments of sterile pinnules are free, these segments being up to 4 mm. wide and 15 mm. long, the edges strongly toothed, having up to 10 pairs of veins, some 3–branched; *scales* on costæ beneath about 1 mm. long, narrow, dark, edge thin and pale, towards apex and base with brown marginal setæ; smaller scales on costules of fertile pinnules not strongly bullate, medium brown to pale, with few to many rather pale marginal setæ; bullate scales especially on some sterile pinnules, rather pale, without dark setæ; *sori* close to costules, completely covering lower surfaces; no indusia; *paraphyses* flattened shorter than sporangia.

TYPE: King's Collector 2416, Larut, Perak.

Some plants at Fraser's Hill have very large fronds, the pinnæ to 75 cm. long, the rachises medium brown, occasionally dark and purplish, but not black, the fertile pinnules to 11 by 1.7 cm., many segments cut to costæ, the upper surfaces recurved.

This species has only been found on mountains, at about 4,000–5,000 feet, in forests, especially in rather open places. The characteristic feature is the much reduced fertile pinnules. The only specimen from outside the Peninsula which I have seen in Forbes 2562 from Sumatra.

PERAK: G. Bubu, 5,000 feet, Wray 3860, King's Coll. 7402; G. Hijau, Fox s.n. Oct. 1899; Larut 5,000 feet, King's Coll. 2416 (type).

PAHANG: G. Tahan: 3,300 feet, Wray & Robinson 5425; Ridley 15994; 5,500–7,000 feet, SFN 7954 (Haniff & Nur); Teku Woods, Ridley 15968 (young plant); 3,700 feet, in forest, SFN 20609 (Holttum). Fraser's Hill, 4,000 feet: Eryl Smith 833; SFN 8492 (Burkill & Holttum), 11401 (Holttum). Cameron's Highlands: Rhododendron Hill, 5,100 feet, SFN 23311 (Holttum); Path to Telom, 5,000 feet, SFN 23537 (Holttum). Kluang Terbang, Barnes 1900 (young plant).

SUMATRA: Forbes 2562 (no locality; date 1881).

15. **Cyathea glabra** (Bl.) Copel. Phil. Journ. Sci. 4C: 35. 1909. *Gymnosphaera glabra* Bl. Enum. 242. 1828. *Alsophila dubia* Bedd. Journ. Bot. 25: 1, t. 279*a*. 1883. *Alsophila vexans* Ces. Atti Acad. Napoli 7, pt. 8, 4. 1876.

*Stipes* dark purplish or almost black, with roughened base; scales fairly numerous but soon deciduous, dark with pale irregular edges. *Rachises* dark to medium purplish brown, subglabrous below, appressed hairy above. *Lowest pinnae* sometimes much reduced, especially on young lowland plants. *Middle pinnae* to 55 by 20 cm., more often about 45 by 15 cm. *Pinnules* of middle pinnæ to 12 by 2 cm., more often about 9 by 1.5 cm. and occasionally smaller, on stalks 2 to 4 mm. long, base slightly unequal, broadly rounded or subtruncate, occasionally slightly auricled on upper side, apex rather shortly narrowed and broadly toothed, edge subentire or slightly lobed, occasionally lobed as much as half way to the costa; lobes where present usually about 5 mm. wide at base, rounded, almost entire; *veins* 3 to 5 pairs, usually all simple, the basal vein on the side towards the pinna-rachis not usually springing directly from the costa (occasionally so towards apex of pinnule); *texture* thin but firm; *scales* on costæ and costulæ beneath not very abundant; scales at base of costæ narrow, dark, with pale edges, sometimes with a few setæ; scales on costules very small, narrow, with usually pale setæ on margins; no bullate scales; *sori* in one or more series on either side of costæ, those on each vein-group being disposed in two close almost parallel rows, not or only slightly converging towards the margin; no indusia.

TYPE: Java, in Blume's Herbarium.

As here interpreted, this species is very variable in the extent to which the pinnules are lobed. I have examined Blume's specimens at Leiden and Kew, and also all specimens from Java in the Buitenzorg herbarium. Java specimens are much less variable than those from the Peninsula; their pinnules are usually lobed about 1/3 to the costa, occasionally almost 1/2. Of 33 Peninsula specimens

in the Singapore herbarium (counting only those with middle pinnæ), 16 have pinnules very slightly lobed, 10 lobed not more than 1/4, and the remaining 7 lobed 1/3 to 1/2. Some of those most deeply lobed seem to me quite indistinguishable from typical Java specimens, and as I can see no sharp dividing line between these and the less lobed specimens, I am of opinion that all should be regarded as one species. Beddome's *Alsophila dubia* was based on a slightly lobed specimen. These slightly lobed specimens are very similar to *Alsophila podophylla* Hk. from Siam and southern China. The most deeply lobed Peninsula specimen is King's Collector 2493 from Larut, Perak; this has the lowest lobes on many pinnules quite free (a condition not seen in Java specimens) and the remainder of the pinnules lobed halfway to the costa. The Peninsula specimen agreeing most nearly with those from Java is SFN 26110 (Corner) from Fraser's Hill.

A specimen from Java (Bakhuizen fil. 3121, from Soekamentri), approaches *C. gigantea* in having almost sessile pinnules, lobed fully half-way to the costa, the lobes rather deltoid and distinctly toothed; there are however never more than 5 pairs of veins.

The minute scales on the costæ and costules of this species are characteristic; in order to distinguish the setæ on their margins, a rather high magnification is necessary.

*Cyathea vexans* (Ces.) C. Chr. from Sarawak, of which I have examined the type, agrees closely with many Peninsula specimens.

*C. glabra* is a fairly common small tree fern in mountain forests; the only lowland specimens are from Singapore and southern Johore, and one from Perak. The lowland plants are usually thinner in texture, agreeing in other respects.

KEDAH: G. Jerai (Kedah Peak): Ridley 5156, 5157; 2,500–3,000 feet, Evans & Gordon 55; 2,800 feet, Robinson & Kloss 6042.

PERAK: G. Bubu, Cantley 2666. Near top of G. B. 3,500–4,000 feet, King's Coll. 7356. Larut, within 100 feet, King's Coll. 2493. Gopeng, King's Coll. 68. G. Kerbau 3,500 feet, Robinson s.n. (distr. Kew).

KELANTAN: G. Stong, 800 feet, SFN 12187 (Md. Nur).

PAHANG: Telom, Ridley 13931. G. Berumban, Ridley 13932. G. Tahan: Wray's Camp, Ridley 16206, 16204; Ridley 15993; 3,500–4,000 feet, SFN 8112 (Haniff & Nur); 3,500 feet, SFN 20570 (Holttum). Fraser's Hill: F.M.S. Mus. 11485 (Henderson); SFN 8797, 8813 (Burkill &

Holttum), 11199 (Md. Nur). Cameron's Highlands 5,000 feet, SFN 23367 (Holttum).

JOHORE: Tempayan River, Ridley 13282. G. Panti 1,600 feet, SFN 15042, 17698 (Holttum).

SINGAPORE: Stagmount, Ridley s.n. 1907. Bukit Mandai, Ridley s.n. 1907. Bukit Timah, Ridley 12554.

16. **Cyathea gigantea** (Wall.) Holttum, comb. nov.

*Alsophila gigantea* Wall. Hook. Spec. Fil. 1: 53. 1846. *Alsophila umbrosa* Ridley p.p. J.M.B.R. Asiatic. Soc. 4: 6. 1926.

*Stipes* black or very dark, slightly roughened, the scales rather small, dark with pale thin edges. Rachises dark to medium purplish brown, smooth and subglabrous below, rather sparsely appressed hairy above. *Middle pinnae* to about 45 by 18 cm. *Pinnules* of middle pinnæ to about 14 by 2 cm., sessile or nearly so, the base slightly unequal, cuneate, narrowed gradually from the broadest part near base to the apex, apex acuminate, edge lobed, the basal lobes as much as 2/3 to costa; *lobes* deltoid, 5 to 6 mm. broad at their base, narrowed distally, slightly oblique, the apex rounded and toothed, the basal lobe occasionally almost free; *veins* 5 or 6 pairs in each lobe, simple, the basal one on the side towards the pinna-rachis usually springing directly from the costa; texture thin; *scales* on costæ and costules few, small, rather pale and irregularly lobed, the margins with short hairs but not stiff setæ except at apex of larger scales; no bullate scales; *sori* on basal veins distant from costules, the higher ones converging, thus forming groups of inverted V-shape; no indusia.

TYPE: Nepal, Wallich 321.

I have examined the types of both *A. gigantea* and *A. umbrosa* (from Penang) in Wallich's Herbarium at Kew, and in my opinion they represent the same species. The type of *A. umbrosa* has pinnæ 1.5 times as wide as those of the type of *A. gigantea*, but otherwise I can see little difference. *A. umbrosa* represents the species at its southern limit in Penang, and *A. gigantea* at or near its northern limit in Nepal.

The characters distinguishing *A. gigantea* from the more deeply lobed specimens of *A. glabra* are: the lobes of the pinnules more deltoid, distinctly toothed, pinnules sessile; veins in each lobe usually 5 or 6 pairs; small scales without stiff marginal setæ. For a clear comparison, middle pinnæ of well-developed fronds are necessary. Upper pinnæ often have narrower less deeply lobed pinnules.

Mr. Ridley cites a number of specimens under *A. umbrosa;* all of these, with the exception of Wallich 1336, are in my opinion *C. glabra.*

Beddome, following the *Synopsis Filicum,* regarded *Alsophila gigantea* as a synonym of *A. glabra;* his *A. glabra* from India is therefore *Cyathea gigantea.* When Beddome received the (rather aberrant) specimens of *C. glabra* from the Peninsula, he called them *Alsophila dubia,* as he had no knowledge of typical *C. glabra* from Java.

KEDAH: Langkawi Islands: Curtis s.n. Sept. 1890; G. Raya, Curtis s.n. Sept. 1890.

PENANG: Highland Hill, 500 feet, SFN 9094 (Haniff). Above Ayer Itam, 1,000 feet, SFN 19340 (Holttum).

LOWER SIAM: Kopah, SFN 2092 (Haniff & Nur).

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**Collectors' Numbers quoted in this Paper**

The following lists give the collectors' numbers in numerical order, and in brackets after each the number of the species as arranged in this paper (e.g., 1 is *Cyathea Brunonis*). Unnumbered specimens are not quoted here.

*Singapore Field Numbers—*

| | | | |
|---|---|---|---|
| 2092 (16) | 9263 (1) | 12091 (1) | 19883 (12) |
| 7127 (5) | 9352 (5) | 12187 (15) | 19910 (5 var.) |
| 7939 (5) | 9450 (5) | 12266 (5) | 20096 (11) |
| 7954 (14) | 9452 (5) | 12269 (2) | 20570 (15) |
| 8038 (1) | 9889 (11) | 12534 (10) | 20572 (13) |
| 8040 (5) | 9919 (2) | 12883 (3) | 20609 (14) |
| 8112 (15) | 10367 (5) | 13217 (1) | 21540 (10) |
| 8492 (14) | 10393 (3) | 15042 (15) | 21560 (13) |
| 8779 (10) | 10690 (8) | 15683 (5) | 21711 (3) |
| 8793 (13) | 10741 (8) | 17124 (5) | 22508 (1) |
| 8794 (5) | 11005 (5 var.) | 17698 (15) | 23311 (14) |
| 8796 (10) | 11199 (15) | 17760 (10) | 23367 (15) |
| 8797 (15) | 11367 (13) | 17802 (7) | 23453 (10) |
| 8812 (3) | 11399 (1) | 18584 (4) | 23537 (14) |
| 8813 (15) | 11401 (14) | 18617 (4) | 23538 (7) |
| 8825 (5) | 11519 (1) | 18871 (3) | 23539 (5 var.) |
| 8826 (1) | 11523 (5) | 19339 (9) | 23705 (13) |
| 9085 (13) | 11535 (1) | 19340 (16) | 24504 (9) |
| 9094 (16) | 11635 (2) | 19341 (2) | |
| 9109 (5) | 11830 (11) | 19579 (5) | |

*Mr. Ridley's Series—*

| | | | |
|---|---|---|---|
| 865 (8) | 6550 (5) | 8633 (3) | 12599 (5) |
| 1659 (5) | 6551 (5) | 8663 (5) | 13279 (5) |
| 3060 (5) | 6552 (5) | 8936 (5) | 13282 (15) |
| 3319 (13) | 6965 (5) | 9548 (5) | 13313 (9) |
| 3540 (1) | 7017 (9) | 9551 (5) | 13439 (5) |
| 4150 (9) | 7040 (9) | 9604 (13) | 13475 (9) |
| 4398 (9) | 7076 (9) | 9857 (8) | 13930 (10) |
| 4401 (9) | 7080 (5) | 10173 (2) | 13931 (15) |
| 4402 (9) | 7150 (5) | 10295 (5) | 13932 (7) |
| 4403 (1) | 7151 (2) | 10785 (5) | 13932 (15) |
| 5156 (15) | 7152 (2) | 10966 (5) | 14207 (5) |
| 5157 (15) | 7153 (10) | 10981 (5) | 15968 (14) |
| 5177 (5) | 7272 (3) | 11061 (1) | 15969 (5) |
| 5185 (10) | 7862 (5) | 11066 (3) | 15993 (15) |
| 5756 (9) | 7865 (5) | 11068 (5) | 15994 (14) |
| 6029 (5) | 7866 (5) | 12535 (5) | 16204 (15) |
| 6031 (9) | 7868 (3) | 12537 (9) | 16206 (15) |
| 6122 (9) | 7869 (13) | 12554 (15) | 16211 (13) |
| 6123 (5) | 7879 (5) | 12557 (9) | 16214 (1) |
| 6549 (9) | 8141 (5) | 12571 (9) | |

*F.M.S. Museums Series—*

| | | | |
|---|---|---|---|
| 7617 (1) | 8712 (11) | 9635 (2) | 10258 (5) |
| 7629 (5) | 8797 (5) | 9793 (1) | 10802 (5) |
| 7673 (1) | 9547 (1) | 10098 (1) | 11315 (5 var.) |
| 7889 (1) | 9548 (1) | 10198 (5) | 11485 (15) |
| 7917 (11) | 9562 (1) | 10201 (1) | |

*King's Collector—*

| | | | |
|---|---|---|---|
| 68 (15) | 2359 (5) | 6391 (10) | 7229 (8) |
| 186 (9) | 2416 (14) | 7129 (8) | 7317 (5) |
| 475 (1) | 2493 (15) | 7130 (13) | 7356 (15) |
| 1280 (3) | 4032 (3) | 7148 (6) | 7402 (14) |
| 1988 (13) | 4885 (1) | 7154 (5) | |

*Forest Department—*

| | | | |
|---|---|---|---|
| 13907 (1) | 14610 (1) | 22867 (10) | 22930 (10) |
| 13984 (3) | 22813 (1) | 22874 (6) | 24107 (5) |

*C. Curtis's Numbers—*

| | | | |
|---|---|---|---|
| 537 (5) | 2692 (10) | 10134 (5) | 10140 (9) |
| 538 (9) | 3074 (5) | 10139 (2) | 10141 (5) |

*Scortechini* 222 (5), 223 (5), 239 (1).
*Wray & Robinson* 5379 (1), 5425 (14).
*Evans & Gordon* 55 (15), 108 (5).
*Derry* 92 (1).
*Anderson* 140 (10).
*Wray* 3860 (14).
*Eryl Smith* 814 (5), 833 (14), 901 (5).
*Robinson & Kloss* 6042 (15).
*Forbes* 2562 (14).

# PALMÆ MALESICÆ

## IV.—Rattans described in Blanco's Flora de Filipinas

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Many attempts have been made to interpret the rattans in Fr. Manuel Blanco's *Flora de Filipinas* (published in Manila in 1837), the latest among them being Merrill's (1918). The earliest interpretations were by MARTIUS (1850) who probably allowed himself to be guided in his work by the frequency with which the species were then collected in the neighbourhood of Manila where Blanco's studies were mainly carried out and also perhaps by their utility about which mention was made by Blanco himself. FR. NAVES (1882) who lived in the Philippines may have identified Blanco's species through a study of the vernacular names and the economic uses, but, as his notions over the specific delimitations of a rattan species were so wide as to enable him to lump together distinct species, his interpretation is not of much scientific value. VIDAL (1883 & 1886) who was better acquainted with rattans and who also worked in the Philippines tried to identify two of Blanco's species one of which has proved to be correct. The most important contribution to the subject was made by BECCARI who, in addition to geographic and economic reasons, tried to detect in Blanco's specific descriptions diagnostic characters that would apply to the Philippine species. Even with such a study Beccari admitted that his interpretation was only tentative and not final, and so in the works published in 1908, 1911, 1913 and 1919 no changes of importance in the nomenclature of the Philippine rattans are involved on the basis of this interpretation. MERRILL (1918) however, published an extensive commentary on Blanco's *Flora* in which he paid great respect to the vernacular names and economic uses given by Blanco and as a result of study of these names, of the uses of the rattans in the Philippines and of their geographical distribution rather than of Blanco's botanical descriptions he made certain identifications either confirming, or dissenting with, those of previous authors. Accordingly he made several changes in the nomenclature of the Philippine rattans involving in some cases new combinations (cf. also Merrill, 1922).

This procedure adopted by Merrill is most unusual. A field botanist often gets a guide inexperienced in the vernacular names of plants and so the information recorded in the field pertaining to vernacular names and economic

uses of a plant is frequently erroneous. Further the intercourse of different tribes or races in a place or the gradual extinction of a plant in the locality due to cutting down of the surrounding forest results sometimes in a gradual change in the vernacular nomenclature. Even Blanco himself, after taking sufficient care to see that the vernacular names incorporated in the book were correct, warned the readers in his preface against taking them as the sure guide in identification of the plants especially because of "the intolerable easiness with which they change and occasion disappointment". (*Sin embargo nadie expere hallar en los nombres una total seguridad, pues es intolerable la facilidad con que los mudan y transtornan*). On the other hand Blanco, without being a trained botanist, drew his specific descriptions from a field study of the plants and sometimes made these descriptions sufficiently extensive. Commenting on the very unfavourable criticisms made by the European botanists on Blanco's *Flora*, Merrill himself writes thus:—

"Considering the circumstances under which it was written, Blanco's *Flora de Filipinas*, even if it is a curious work, is also a remarkable book in some respects. Few botanists in any country or in any time have laboured under greater disadvantages, and Blanco must be credited with initiative, industry, and perseverance. Most of the facts recorded are the result of his observation, and even if he did make numerous grave errors in interpretation of species, his descriptions, as such, on the whole compare favourably with those of his contemporaries. *In fact his descriptions in general, on account of their length, are distinctly superior to very brief diagnoses appearing in the older botanical literature as a means of interpreting the species intended.* The fact should not be overlooked that species proposed by the early European authors, frequently very imperfectly characterized, are more often interpreted by an examination of the actual type specimens preserved in various public and private herbaria, than by the descriptions themselves; in fact a very high percentage of all species described are more or less unintelligible without access to the actual specimens, or duplicates of them, on which they were based. Unfortunately Blanco preserved no herbarium material, and accordingly his species must be interpreted solely by the published data." (1918, p. 24. *The italics are mine*).

Merrill's novel procedure in interpreting Blanco's species and, at the same time, his assurance that Blanco's descriptions were a result of personal observations and were of sufficient length to be worthy of regard induced me to consult the first edition of Blanco's *Flora* and to see whether the rattans listed could be identified on their descriptions.

Since the conclusions I have arrived at were unexpected I may be excused for dealing with them somewhat lengthily.

In studying Blanco's species one must be prepared to make several allowances. Blanco acknowledged that he had had no botanical training and made no claim to being a botanist. He wrote his book for his own use as a hobby; but he was urged to publish it by "some persons who had heard of my work"[1]. Further it must be remembered that until recently several botanists described palms in wrong terms, this being especially the case with the descriptions of rattans where the long cirrus to the leaves might be mistaken for a young shoot. This means therefore that one must be prepared to find quite wrong use of botanical terms in the descriptions of the rattans. To my surprise I have found that an adequate allowance has not been made for such eventualities in Blanco's descriptions of the rattans so that it has been difficult to interpret his descriptions. I shall consider here the most important terms in these descriptions that require definition if one is to understand Blanco correctly:

HOJAS: Until recently palm leaves were "branches" to non-botanists, the leaflets being regarded as the real leaves (The other extreme was to regard as compound leaves, branches of definite growth found in such plants as *Phyllanthus* spp. cf. Roxburg's *Flora Indica*). To Blanco the real rattan leaf is also a "branch" and the leaflets are "leaves" (*Hojas*), and when he speaks of the *Hojas* arising from *"los nudos de tallo"* he apparently means that the leaflets arise from the leaf-rachis more or less at places marked by hooked spines beneath, regarding these claws as signs of the nodes (*nudos*). Since he describes in distinctive terms the *Hojas* (leaflets) which are alternate or in groups, I think I am justified in taking *Hojas casi opuestas aladas* to mean that the leaflets are close and equidistant and therefore "almost opposite", a condition not usually found in other leaves where the leaflets are inequidistant or very far apart.

1. "Nunca fue mi pensamiento formar un Tratado de plantas, digno de la luz publica. Una simplice curiosidad me habia hecho ir escribiendo lo que parecia interesante; pero algunos sugetos que tubieron noticia de mi trobajo, me instaron mucho a que le publicase, .....
La historia pues de las plantas de Islas Filipinas debia haverla emprendido un Botanico de profesion, que mereciese la confianza de los sabios, y que se pudiese presentar sin rubor al Publico ilustrado de estos tiempos. Yo no he tenido Maestros, ni herbarios, ni aun casi libros, cuando empecé por aficion à entender en esta materia. Mi unico libro entonces era el *Systema vegetalium* de Linneo. Aquiri pasados algunos anos otras obras del mismo Autor, y mucho tiempo despues el libro immortal de *Genera plantarum* de Jussieu con otros libros." (From the *Preface*).

HOJUELAS: But if this be granted, what are Blanco's *Hojuelas?* Blanco must have read descriptions of some *Calamus* species where leaflets are described and perhaps interpreting the term leaflets (*hojuelas*) in its literal sense meaning "small leaves" he must have taken it to mean the shorter leaflets that are usually found at the apex of the leaves; or it is possible that he used this term when he wished to describe the characteristics of each one of the leaflets. In Blanco's descriptions both *Hojas* and *Hojuelas* mean leaflets.

PECIOLOS: If *Hojas* and *Hojuelas* be both taken to mean leaflets, it is natural to question the status of Blanco's term *Peciolos,* for rattan leaflets are sessile. In his descriptions Blanco uses this word twice, once under *C. usitatus* and again under *C. maximus,* and once again in describing the way the Philippine people manage to get rid of the spines off the rattans; and it appears from these references that Blanco uses the term in its correct botanic sense to mean petiole. It is strange that while Blanco uses the word *tallo* or *tronco* to mean the real stem as well as the leaf-rachis, he should use an appropriate term to denote the petiole. [I have known people call the coconut leaves branches and yet use word leaf-stalk to mean petiole].

If these interpretations regarding *Hojas* and *Hojuelas* are not accepted, then Blanco's descriptions which were drawn after an actual study of the plants become at once fantastic and impossible of any interpretation except in the way Merrill has done, that is, by attaching the greatest importance to the vernacular names and the economic uses which were cited on the authority of native helpers. Blanco speaks of *Hojas* being ensiform (*figure de espada*), opposite or alternate, solitary or in groups of twos or threes, etc.—characteristics which can never be applied to the real leaves of rattans. If on the other hand this interpretation is accepted then the species become less confusing than they are hitherto supposed as will be seen from the interpretations given below.

**Calamus gracilis** Blanco.

This binomial being antedated by *C. gracilis* Roxb., Kunth (*Enum. Plant.* III, 1841, p. 595) proposed the new name *C. Blancoi* for Blanco's *C. gracilis.* Naves (1882) identified this species with *C. buroensis* Mart. probably because of the resemblance of the leaves of the latter to those of a plant identified by him as the *Talola*—the vernacular name quoted by Blanco under *C. gracilis.* Beccari (1902 p. 204) enumerated the following synonyms under *C. Blancoi: C. brevifrons* Mart., *C. parvifolius* Vidal., and *C. usitatus* Blanco *sensu* Mart. In the *Calcutta Annals*

(1908 p. 216) Beccari excluded from *C. Blancoi* the synonym *C. usitatus* Blanco *sensu* Mart. because he found it was actually the female of *C. mollis* Blanco *sensu* Martius, Beccari, etc. and explained the status of his identification thus: "This [*C. Blancoi*] is a much more slender plant than *C. mollis*, but is however very closely related to, and possibly only a variety of that species ..... ..... It is not certain that Cuming's No. 1225 really corresponds to the *C. gracilis* of Blanco, a name which has been changed by Kunth into that of *Blancoi*, the first having been previously employed by Roxburgh for an Indian species. Nevertheless in the absence of those of Blanco, we may take as the type-specimens those distributed by Cuming under the above mentioned number 1225."

Confirming the identification of Beccari, Merrill (1918 p. 86) wrote thus: "This species is manifestly very closely allied to *Calamus usitatus* Blanco (*C. mollis* Auct., non Blanco) and is perhaps identical with it. I have seen no specimen of *Cuming 1225*, or *Loher 1376*, on which Beccari based his conception of *Calamus Blancoi* but our Batangas material of *talola* [the vernacular name given by Blanco] seems to agree with the figure given by Beccari, taken from *Cuming 1225*, and with the description..... Batangas is the only province, so far as our collections and data show, where *talola* is in use as a name for *Calamus*, and it is apparently generally applied to the specific form distributed herewith. The closely allied *Calamus usitatus* Blanco (*C. mollis* Auct., non Blanco) is known in the same locality as *talolang lutukan*. The striking differences are that in *Talola* the leaflets are constantly solitary, while in *talolang lutukan*, and in very many of our numerous specimens of *Calamus usitatus* some of the leaflets are frequently paired on the same side of the rachis. It was erroneously reduced by Naves to *Calamus buroensis* Mart., a species that does not extend to the Philippines."

As to the vernacular name *talola*, I find it mentioned by Merrill (1922, I p. 153) also under *C. siphonospathus* which shows that it may not be a sure guide in the identification of the species. According to Mercado (1880 p. 50), the *talola* is a slender rattan sometimes attaining the thickness of a thumb—a probable reason why it was called *gracilis* by Blanco—and both Mercado and Blanco state that it is a source of the rattans used by the magistrates (*ministros de justica*) [for punishing criminals]. It appears to me therefore that the word *talola* was commonly used in and around Manila for any *Calamus* that supplied the thin rattans used in the courts of justice and it is extremely doubtful whether Blanco or a Filipino would have been able to distinguish between *C. usitatus* Blanco

*sensu* Merrill and *C. Blancoi* Kunth *sensu* Beccari and say from which of the two the magistrates derived their canes, especially when the canes are so much alike as to puzzle even expert botanists.

Further Blanco says that the leaflets in *C. Blancoi* Kunth (= *C. gracilis* Blanco) are very often grouped in pairs on each side of the rachis, the pairs sometimes being opposite and sometimes alternate in one and the same leaf or plant (*Hojas ya opuestas ya alternas, aladas de dos en dos, y tambien simples*). The only species to which this description applies is *C. mollis* Blanco *sensu* Naves and Beccari which is identical with *C. usitatus* Blanco *sensu* Vidal and Merrill. Being also very common (*mui comun*) as stated by Blanco, in the neighbourhood of Manila, it was probably also a source of *Talola* used in the Manila courts. *C. Blancoi sensu* Beccari and Merrill, on the other hand, has leaflets which are usually solitary and is also a rare plant in the Philippines. As to the spinescence of the leaflets, *C. usitatus sensu* Vidal and Merrill is extremely variable, and one could establish several varieties on this character.

Therefore I consider the name *C. Blancoi* Kunth (the type of which is *C. gracilis* Blanco) should be given to the plants referred by Martius, Naves and Beccari to *C. mollis* Blco. and by Martius, Vidal and Merrill to *C. usitatus* Blco. *Calamus Haenkeanus* Mart. is also to be referred here. But *C. brevifrons* Mart. which was hitherto regarded as a synonym of *C. Blancoi* Kunth is a different species and becomes a valid name of which *C. parvifolius* Vidal (non Roxburgh) is a synonym. *C. buroensis* Mart. to which *C. gracilis* Blanco (= *C. Blancoi* Kunth) was referred by Naves does not occur in the Philippines.

**Calamus maximus** Blanco.

This was until recently listed as an unidentifiable species and Naves (1882) suggested that it may be a *mixtum compositum*. In 1904, however, Beccari thought that he recognised it in a Philippine plant communicated to him by Merrill sub. no. 1893; later, as a consequence of an examination of more extensive material from the Philippines, Beccari (1905) relegated Blanco's species as a synonym of *C. ornatus var. philippinensis*, making Merrill's specimen the type of a new species, *C. Merrillii* Becc., a view upheld by him in his later works (1908; 1919). A difficulty however arose from this interpretation, for the leaflets in *C. ornatus v. philippinensis* are without any bristles on their costæ, whereas in *C. maximus* they are described as having bristles on their two lateral nerves above and the median nerve beneath. Beccari explained away this difficulty by

supposing that the leaflets of younger plants are perhaps spiny according to the description, for he had noticed a very similar phenomenon occuring in the Malayan forms of *C. ornatus*, which are also quite bare in their advanced stages.

Merrill however does not accept this interpretation by Beccari and upholds Beccari's original interpretation as correct on the grounds that the natives still apply almost exclusively the word *Palasan* [one of the vernacular names quoted by Blanco] to *C. Merrillii*, and *Limoran*[1] to *C. ornatus var. philippinensis* and that Blanco's description of the leaflets "applies unmistakably" to *C. Merrillii*. Now Blanco describes the leaflets thus: "*Hojuelas* lanceoladas, con tres nervios notables, y en los dos laterales una hilera de pelos tiesos en la pagina superior y en la inferior una so hilera de lo mismo" (leaflets lanceolate, distinctly 3–nerved, armed with rigid hairs along the two lateral nerves above and along one [median] nerve beneath).

Against Merrill's interpretation one can raise equally good objections as against Beccari's. The leaflets of *C. Merrillii* are provided on the nerves with very long setæ which by no means can be said to be rigid (*tiesos*) and which are found many times on both surfaces and the leaflets are not lanceolate but what Blanco would have called *de figura de espada* (ensiform). Further judging from the vernacular names cited by Naves (1882) the word *Palasan* had been applied to more than one species in the Philippines. If one disregards the hairiness on the leaflets and attaches more importance to the economic uses mentioned by Blanco, there appears to be stronger reasons in favour of Beccari's interpretation than that of Merrill's. Blanco says that *C. maximus* is a common and well-known rattan, the native using its strips for various and delicate wicker works and that its fruits are edible with a not unpleasant taste. [Mercado mentions practically all these uses under the rattan *Palasan* p. 50]. Among the various vernacular names given by Blanco there occurs not only the word *Palasan* but also *Calapi*, the latter being used, according to Blanco, in two native dialects. Now *C. ornatus v. philippinensis* has not only lanceolate leaflets and *una semilla oblonga com cuatro angulos confusos* (oblong, obscurely 4–angled seeds) as Blanco describes, but is also called *Calapi* in the vernacular language and has economic uses like the one mentioned by Blanco. I may be allowed to quote here from Elmer's field-notes edited by Beccari in *Elmer's*

1. The vernacular name *Limoran* has been quoted by Beccari (1913, p. 126) under *C. discolor* var. *negrosensis* Becc., but from Merrill's account (1922, p. 148) it appears that the name should have been spelt as *Simoran* or *Simuran*, for Merrill quotes the last name and not the one quoted by Beccari.

*Leaflets Philipp. Bot. VIII*, 1919, p. 3054: "This is quite common in the woods and forests about Irosin [in Luzon], and is called *Calape* by the Biconales. The natives in other parts of Luzon also call it by that same name, and in central Samar there is a town by the name *Calape*. Its deep cream coloured fruits when ripe are juicy and vinegar sour. The natives of Sorsogon province are very fond of it, and in the fruiting season it is extensively collected and brought into the local markets for sale. A bunch or hand costs five to ten centavos according to its size. Because of the difficulty in getting at the fruit clusters, the natives cut the stem near the ground and pull the plant with the fruits down for its ripe bunches.....Again, instead of utilizing the stem by cutting it into rattan strips, it is wastefully discarded."

On *C. Merrillii* Elmer's field-notes run thus: "A very coarse and practically worthless rattan. The Manobo name is *Palasan*."

But returning to Blanco's original description, it appears that Blanco based most of his specific description on a flowering specimen collected by him in the jungle, while the description of the frutis and the enumeration of its vernacular names and economic uses may have been added after its identification by some inexperienced native guides with *Calapi* of the markets; for what impressed Blanco most about *C. maximus* was the peculiarly shaped spathes and spathels in the inflorescemce, of which organs he does not make any mention in the description of other species. He describes the inflorescence thus: "*Flores* en panojas compuestas de espigas, con las florecillas distichas y mui apretadas; cada espiga tiene en la base un involucro de figura de embudo. Cada florecilla tiene igualmente en la base una escama de la misma figura." Considering that in a non-technical language *Espiga* may be used for a partial inflorescence and that modern terminology of *Calamus* inflorescence was not known even in quite recent times, I translate Blanco's text thus: "Inflorescence paniculately branched, the flowers being distichous and very close. At the base of each partial inflorescence (*espiga*) there is a funnel-shaped spathe (*un involucro de figura de embudo*). The base of each flower (*i.e.* involucrophore), has also a similarly shaped spathel (*escama*)." Now *C. siphonospathus* Mart. is the only species that satisfies these conditions regarding the inflorescence and which would have attracted the attention of even an untrained botanist like Blanco to the infundibuliform spathes and spathels, and that has at the same time lanceolate, almost opposite (*casi opuestas aladas*) and, therefore equidistant leaflets bearing spines on both surfaces. This species is extremely variable

as regards the spinescence on the leaflets, and though one very often gets forms having leaflets spiny along the three nerves above and only the midrib beneath, it is possible that Blanco had a specimen where only the lateral nerves above and the midrib beneath had spines. It is also a species that is quite frequent in the neighbourhood of Manila.

I consider therefore that *C. maximus* Blco. should stand for the plant described by Martius as *C. siphonospathus*. *C. Merrillii* Becc. becomes therefore a valid species. *C. albus* Pers. and *Daemonorops melanochaetes* Bl., which together with *C. siphonospathus* Mart. were referred by Naves to *C. maximus* Blco., are extra Philippine species.

**Calamus mollis** Blanco.

Martius was the first botanist to identify this species. In the *Synopsis* (1850, p. 336) he described it at length basing his description, as pointed out by Beccari (1908), on a male specimen collected by Gaudichaud in the Luzon island of the Philippines. As Martius referred his specimens to Blanco's species principally on the basis of the uses given by Blanco and on its occurrence in the neighbourhood of Manila, and not on Blanco's botanical description, he could not be sure of his identification. Naves (1882) who had access to Vidal's herbarium, which had been worked out with the aid of Martius, recognised *C. mollis* in *C. Haenkeanus* Mart. He illustrated a plant showing both the male and female spikelets as *C. mollis* Blco. with *C. Haenkeanus* Mart. as synonym. Vidal (1883) depicted an identical plant with its male and female parts under *C. usitatus* Blco. with a note that the species was cultivated under that provisional name in the Botanical Gardens in Manila; and later (*fide* Beccari 1902 & 1908) he identified with *C. mollis* Blco. a plant identical with *Daemonorops Gaudichaudii* Mart. Beccari (1908, p. 214) pointed out that Martius's *C. usitatus* was in fact the female of *C. mollis* Blanco *sensu* Mart. This was perhaps the reason for divergence of opinions between Naves and Vidal (both of whom worked in the Philippines) regarding the identity of *C. mollis* and *C. usitatus*. Beccari agreed with Naves's interpretation of *C. mollis* Blco. but did not feel himself "quite certain that the *Calamus* named by Martius as *C. mollis* is really that published by Blanco under this name, but in the absence of authentic specimens of the true *C. mollis*, I have followed Martius." In another place of the same monograph (p. 37) he wrote thus of the species: "*C. mollis* is apparently a common species in Philippines for it has been met with again and again by all modern botanists and we may consider its identification as assured."

Merrill (1918) did not agree with Beccari's interpretation and identified the species (*C. mollis* Blco.) with *C. usitatus* Blco. *sensu* Beccari (*i.e. Daemonorops Gaudichaudii* Mart.) transferring the name *C. usitatus* Blanco to what Beccari had called *C. mollis* Blco., thereby restoring to *C. usitatus* Blco. the interpretation originally given by Martius (partly) and Vidal. Merrill's reasons for this interchange of names was that the leaf characters and the vernacular names *Uay* quoted by Blanco under *C. usitatus* agreed well with the plant named *C. mollis* by Beccari, while the vernacular name *Ditan* quoted under *C. mollis*, the non-edibility of the fruits and the general description of the species agreed with *D. Gaudichaudii*. Hence he made a new combination of *C. mollis* under the genus *Daemonorops*.

In the first edition of Blanco's *Flora* it is recorded that the fruits are non-edible, but in the later editions a further information is added: "En el vocabulario tagalo, se dice que es venenosa; y en efecto el fruto no es comestible." I have not seen anywhere else remarked that *D. Gaudichaudii* is a poisonous (*venenoso*) rattan, while Elmer's field notes (Beccari, 1919-*b*, p. 3032) say that the fruits are sweet. As to the vernacular name *Ditan* Merrill himself (1922, p. 157) quotes it also as a local name for *D. ochrolepis*.

However from Blanco's description of the perianth—a point hitherto overlooked—it is evident that *C. mollis* Blco. is a true *Daemonorops* and not a *Calamus*. Blanco had an occasion to examine the perianth of other rattans, but only of this species he uses the word *Pequenisi nas* (very small or minute) to describe the size of the calyx, mentioning at the same time that the corolla is larger. This description of the perianth unmistakably applies to a *Daemonorops* with a particularly short calyx. Further according to my interpretation of Blanco's descriptions, the leaflets are ensiform and arise more or less at a place which on account of the claws on the dorsal side looks like node (*salen en los nudos del tallo*). This means therefore that the leaves of this *Daemonorops* bear approximately as many pairs of leaflets as there are claws on the laminar part of the rachis, and that the leaflets are more or less equidistant or subequidistant. In all these characters Merrill's identification appears to be correct and as *Daemonorops Gaudichaudii Mart.* is the one common species of *Daemonorops* in the vicinity of Manila, Merrill's identification is supported by this additional evidence.

In view of this I regard *Daemonorops mollis* (Blanco) Merrill (of which *C. mollis* Blco. is the type synonym) as a legitimate name for a plant described by Martius as *D.*

*Gaudichaudii* and interpreted as *C. usitatus* Blco. by Beccari. *C. mollis* Blco. *sensu* Martius, Naves and Beccari is, as shown above (cf. the discussion under *C. gracilis* Blco.), a synonym of *C. Blancoi* Kunth.

**Calamus usitatus** Blanco.

As explained above (*vide* the discussion under *C. mollis*) Martius identified this species with a female plant, the male of which was thought by him to represent *C. mollis* of Blanco. Naves (1882) regarded Blanco's species as a mixture of two species, one being a true *Calamus* (*C. psicarpus* Bl.) and the other a *Daemonorops* (*D. Rumphii Mart.*). Naves did not state his reasons but, as pointed out above, he may have been led to these conclusions through a study of the vernacular names and the uses of the plants in the Philippines. Vidal (1883) depicted as *C. usitatus* a plant identical with *C. mollis* Blanco *sensu* Naves and Beccari. Beccari, however, reduced this to *D. Gaudichaudii* and explained his reasons for doing it thus: "I have reduced *Calamus usitatus* of Blanco to *Daemonorops Gaudichaudii* more by exclusion than by the vague characters assigned to it by that author. In fact I consider *C. usitatus* to be a *Daemonorops* chiefly by reason of the character Blanco gives of its calyx "*persistente de seis piezas, las tres exteriores mas grandes*". No doubt that by calyx Blanco really means the perianth and the assertion that the 3 external parts of it are larger than the internal may be a slip for the reverse. Now there are no *Calami* that have the corolla of the female flowers much larger than the calyx. The globular and apparently large fruit (as it is said that the involucre of its seed is edible) and its frequency near Manila whence no other species of *Daemonorops* is known, are the reasons which have induced me to identify *C. usitatus* with *D. Gaudichaudii*" (1908 p. 159).

On these reasonings Merrill disagreed with Beccari and regarded Blanco's species as true *Calamus* and precisely *C. mollis* Blanco *sensu* Naves, and Beccari (*i.e. C. usitatus* Blanco *sensu* Mart., and Vidal). His reasons are as follows: "Beccari has interpreted *Calamus usitatus* to be a *Daemonorops* chiefly from the calyx characters given by Blanco. I interpret it especially by the leaf characters given by Blanco, its great abundance at low altitudes in the provinces contiguous to Manila, its edible fruits, and the almost universal and nearly exclusive use of the native name *uay* for this plant."

I have no acquaintance with the Philippine peoples nor with their dialects, and I think it is too much to expect such an acquaintance from an ordinary student of a flora of that country. But it is interesting to note that, according to

Mercado's studies (*op. cit.* p. 50), the Philippine vocable *Ouay* (*uay* or *uai* being only its variants) is a generic name of the rattans and therefore corresponds to the *Bejuco* of the Spanish. Further I find that the word is mentioned by Merrill in his *Enumeration* (I, 1922) under the following species: *C. arugda; C. Blancoi* (spelt as *u-uai*) ; *C. grandifolius; C. ornatus v. philippinensis; C. usitatus* Blanco *sensu* Merrill and also its *var. major;* and *D. Gaudichaudii;* and in a subsequent volume of the same work (IV, 1926, p. 38) Merrill states that the triphthong *Uai* merely means "rattan" so that it is used as a suffix to indicate climbing, rattan-like plants. Further under *C. usitatus,* Blanco also mentions the vernacular name *Yantoc* which according to Mercado (p. 50) is distinctive name for a *Calamus sp.;* but Merrill (*op. cit.* I, 1922) quotes it under *C. Blancoi, C. spinifolius, C. usitatus* Blanco *sensu* Merr., *C. Vidalianus* and *D. Gaudichaudii* and in the final volume of the work (IV, 1926, p. 26) he has noted that this vocable is used in the Philippines in a generic sense for the species of *Calamus* and *Daemonorops.* This means that both vernacular names quoted by Blanco lack precision and cannot therefore be used in a decisive interpretation of the species. As to the leaf-characters, it is evident that Merrill overlooked the characters given by Blanco under the term *Hojas;* for *C. usitatus* Blanco *sensu* Merrill (=*C. Haenkeanus*) has leaflets which are subequidistant or inequidistant, whereas Blanco describes *C. usitatus.* thus:

"*Hojas* ya opuestas, ya alternas aladas, de dos en dos o' de tres en tres, sin rodear al tronco sino en los nudos. *Hojuelas* lanceoladas con tres nervios, y en ellos en la pagina superior y en las orillas, hai una hilera de espinas." Bearing in mind the considerations I have made in the introduction of this paper I translate this text thus: "Leaflets are borne in groups of twos or threes but do not surround the rachis, though from the point of attachment they spread in all directions (*sin rodear al tronco sino en los nudos*), the groups themselves being now opposite now alternate. They (leaflets) are lanceolate and three-nerved and are armed with spines along the three nerves above and along the margins."

Now *C. ramulosus* and *C. microsphaerion* are the only species from the Philippines to which this description of the leaflets can apply. But since Blanco described the petiole (which in Blanco's sense includes also the leaf-sheath) being full of spines (*llenos de espinas*) and as in *C. microsphaerion* the petiole is quite unarmed and the leaf-sheath is smooth or sometimes sparingly spinous, *C. microsphaerion* could not be Blanco's *C. usitatus.* This means that Blanco's species should be identified with *C.*

*ramulosus*. In this last, however, the petiole is very small or absent, though the leaf sheath is much armed with spines; but Blanco might have imagined that this absence of the petiole was due to its being expanded for almost all its length into a sheath and therefore remarked in the specific description that the petiole is long-sheathed (*Peciolos envainan largamente al tallo*). This species is very scarce in the Philippines being found only once in the Province of Tayabas which is not very far distant from the principal area explored by Blanco; but it is possible that it was formerly more frequent and that perhaps by reason of its uncontrolled exploitation by the natives it became scarce, just as it is apparently the case with the allied species *C. microsphaerion* which, owing to its rareness and discontinuous distribution in widely separated places from the Bataan Province of the Luzon Island, to the island of Culion and Palawan, appears to have been formerly more frequent and abundant. But there is no evidence to show that in Blanco's time *C. usitatus* Blco. was a very common rattan; nor can one infer from Blanco's treatment that the rattan was by any means common or that it occurred in the neighhourhood of Manila; for it is the only rattan regarding the distribution and frequency of which Blanco did not express any opinon in his *Flora,* though he noted that the plant was well-known to the natives. May not this silence and the fact that he described only the fruiting perianth, and not the perianth of the flowers as in other long descriptions mean that even in Blanco's time this plant was by no means abundant and that for this reason he could not obtain flowering specimens for his description? It is also possible that the specimen was obtained for him by the natives of the place who, he said, were well acquainted with the plant.

*C. ramulosus* as described by Beccari has leaflets which are quite unarmed on both surfaces, while *C. usitatus* Blanco is described to bear spines in the three upper nerves of the leaflets; but from the analogy it is not improbable that the younger stages of *C. ramulosus* produce leaflets bearing spines in the three nerves on the upper surface. Regarding the armature of the leaflets, it may be remarked that *C. Haenkeanus* Mart. (= *C. Blancoi* Kunth as interpreted here) with which Blanco's *C. usitatus* has been identified by Merrill has leaflets which are spiny in both surfaces and not, as in Blanco's species, only in the upper surface, though in the former species the spines on the lateral nerves may be absent. *C. ramulosus* Becc. has also globose fruits with scales coloured red-brown along the margins (*escamas coloridas*).

Now coming to the difficulty of interpreting Blanco's description about the perianth in which he says that the three segments of the outer whorl of the perianth are larger than those of the inner one, it must be remembered that Blanco described the perianth from fruiting specimens (for which reason he described it as persistent). If a person unacquainted with the morphology of *Calamus* were to look at the fruiting perianth, he might easily overlook the calyx segments and mistake the three staminodial segments that project out of the perianth cup for the corolla. The perianth thus construed would consist of two whorls with the inner segments often shorter than the outer ones. This assumption has at least equal merits with Beccari's in which it is supposed that Blanco, through a slip, inverted the description of the calyx and the corolla. According to my interpretation, *C. usitatus* Blco. is a true *Calamus* and not a *Daemonorops*.

I therefore regard *C. usitatus* Blco. as a legitimate name for a plant described by Beccari under *C. ramulosus*. *Daemonorops Rumphii* Mart. and *C. psicarpus* Bl., with which Naves identified *C. usitatus* Blco. are plants which do not occur in the Philippines. As explained above, *C. usitatus* Blco. *sensu* Martius, Vidal, and Merrill is a synonym of *C. Blancoi* Kunth (= *C. gracilis* Blanco), and *C. usitatus* Blco. *sensu* Beccari is of *Daemonorops mollis* (Blco.) Merr. (= *C. mollis* Blco).

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**Summary**

In the previous interpretations of the rattans described in Blanco's *Flora de Filipinas* parts of Blanco's descriptions, which are of material assistance in the identification of his species, have been left out of consideration. The chief reason for this omission was the mistaken terminology used by Blanco in framing his descriptions. I have tried in this paper to make clear the misleading portions in Blanco's descriptions, and on the basis of this I have been obliged to disagree with the three of the four identifications hitherto made and for the fourth I have found other reasons to accept the interpretation as correct than the mere use of the vernacular name. The various interpretations may be summarised under four valid names thus:—

**1. Calamus Blancoi** Kunth *nom. nov.* Enum. Pl. III (1841) 595.

TYPE SYNONYM: *C. gracilis* Blanco *sp. nov.* Fl. Filip. (1837) 267, not of Roxb.

SYN. NOV.: *C. Haenkeanus* Mart.; *C. mollis* Blanco *sensu* Martius (1850), Naves (1882), & Beccari (1902 & 1908); *C.usitatus* Blanco *sensu* Martius (1850), Vidal (1883) and Merrill (1918).

PREVIOUS INTERPRETATIONS: It was regarded as identical with *C. buroensis* Mart. by Naves (1882); and with *C. brevifrons* Mart. by Beccari (1902 & 1908) and Merrill (1918 & 1922). (*C. brevifrons* Mart. acquires a new status and becomes a legitimate name).

**2. Calamus maximus** Blanco Fl. Filip. (1837) 266.

SYN. NOV: *C. siphonospathus* Mart.

PREVIOUS INTERPRETATIONS: It was regarded as identical with *C. albus* Pers. for the greater part of the description or alternately as a mixture of *C. siphonospathus* Mart. and *Daemonorops melanochaetes* Bl. by Naves (1882); with a plant which later became the type of *C. Merrillii* Becc. by Beccari (1904); *C. ornatus* var. *philippinensis* Becc. by Beccari (1905 & 1908); and *C. Merrillii* Bec. by Merrill (1918).

**3. Dæmonorops mollis** (Blanco) Merr. Spec. Blancoan. (1918) 86.

TYPE SYNONYM: *Calamus mollis* Blanco. Fl. Filip. (1837) 264; Vidal [1886, *fide* Beccari (1902 & 1908)] and Merrill (1918).

OTHER SYN.: *C. usitatus* Blanco *sensu* Beccari (1902 & 1908); and *Daemonorops Gaudichaudii* Mart.

PREVIOUS INTERPRETATIONS: It was regarded by Martius (1850) as a plant which later proved to be the male of *C. Haenkeanus Mart.* and of *C. usitatus* Blanco *sensu* Martius (1850), Vidal (1883) and Merrill (1918); *C. Haenkeanus* Mart. by Naves (1882) and Beccari (1902 & 1908). (These binomials are regarded here as the synonyms of *C. Blancoi* Kunth.).

**4. Calamus usitatus** Blanco Fl. Filip. (1837) 265.

SYN. NOV.: *C. ramulosus* Beccari.

PREVIOUS IDENTIFICATIONS: It was identified by Martius (1850) with a plant which later proved to be the female of the species identified by him as *C. usitatus* Blanco and therefore identical with *C. Haenkeanus* Mart.; with *C. psicarpus* Bl. and *Daemonorops Rumphii* Mart. by Naves (1882); with a plant identical with *C. Haenkeanus* Mart. by Vidal (1883) and by Merrill (1918); *Daemonorops Gaudichaudii* Mart. by Beccari (1902; 1908, 1911). [Beccari's *C. usitatus* Blanco is *C. mollis* Blanco (= *Daemonorops mollis* Merr.) and *C. usitatus* Blco. *sensu* Vidal and Merrill is *C. Blancoi* Kunth as here interpreted].

## Conclusions

The present inquiry into the rattans described by Blanco shows the inadvisability of accepting as decisive interpretations of long-forgotten and dubious species, when such interpretations are based principally on the vernacular names and the economic uses mentioned by their authors.

It is an accepted principle in the taxonomy of plants that, in the interpretation of old and inadequately described species the types of which are not extant, considerations on plant geography should be our most important guide. But if such considerations combined with the original botanical descriptions do not help one to identify a given species or to reject a given interpretation of a species, it should be, in my opinion, illegal to revive a specific name or to reject an accepted interpretation on the basis of the application of the vernacular names by indigenous peoples or on the economic uses of the species, even though these names and uses formed a part of the orginal specific descriptions. Such interpretations may show the probability of the species intended by the author and supply a clue to the ultimate identification of the species on a scientific basis, but they cannot be accepted as decisive. So also changes in the current nomenclature of the species should be invalid when based on the study of the vernacular names and the economic uses of the plant mentioned in the description of the species, if unaccompanied by botanical reasons.

The need for such prohibitions is obvious. A plant-collector or a field-botanist usually depends on native helpers for his information on such particulars and one cannot be sure that these helpers are expert in recognising the plants, or whether or not the information supplied is applicable to more than one species. In the case of plants which are entirely cultivated and do not exist in a wild state the case may perhaps be somewhat different; but it is better in the interest of stability in the nomenclature of plants to discourage even here the revival of long forgotten or dubious binomials on such grounds. If such provision be not made, then several hundreds of unidentifiable species could be resurrected entirely on the study of their vernacular names and even then one could pick out flaws and give a different interpretation on somewhat similar data collected by other persons, permitting thereby the rejection of well-known and well described binomials without any necessity or proper reason, and contributing to the instability of the nomenclature of the plants—a frequent cause of objection by horticulturists and foresters against the rule of priority.

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Further if the principle of reviving old binomials on the basis of vernacular names and economic uses mentioned by their authors, or rejecting on such grounds earlier interpretations based on systematic characters is admitted, it means that the information recorded on these subjects (vernacular names and economic uses) is at least of equal value and importance as the systematic descriptions in validating the publication of a species and that one could on this principle validly publish a species merely by mentioning under a proposed binomial its vernacular names and its economic uses. Systematic botanists would then depend on philologists, economic botanists, historians, etc. for the accurate interpretation of a species.

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## PALMÆ MALESICÆ

### V.—Notes on Some Malayan Dæmonorops

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This paper embodies the notes I have made on some doubtful, rare, imperfectly known, or new species of *Daemonorops* of the section Piptospathae represented in the Singapore and the Kepong* herbaria. The following seven are described as new species or varieties: (*a*) **D. brachystachys**, **D. Kunstleri** var. **langkawiensis** and **D. pseudomirabilis** var. **malayanus** from the Malay Peninsula; (*b*) **D. calothyrsus** and **D. longipedunculatus** from Borneo; (*c*) **D. lasiospathus** from the Malay Peninsula and Borneo; and (*d*) **D. confusus** from Sumatra. Owing to the scanty material available of **D. propinquus** from the Peninsula, Beccari based his specific description on more than one specimen. It is shown that not all the specimens utilised in the description belong to this species, and that Ridley had at one time included under *D. propinquus* specimens belonging to *D. leptopus* (cf. synonymy and remarks under *D. brachystachys, D. confusus, D. micracanthus* and *D. didymophyllus*). *D. propinquus*, as defined here, is purely a peninsular species; the Sumatran material referred to this species is apparently **D. confusus.** As a result of good herbarium specimens collected by the personnel of the Forest Research Institute, Kepong, I have been able to reduce *D. draconcellus* to **D. micracanthus,** thereby extending the range of the latter to Borneo. Apparently this is the species that produces the best "Dragon-Blood" of commerce both in the Peninsula as well as in Borneo. Of the four peninsular species belonging to the sub-section Resiniferae, **D. brachystachys** appears to be the most scarce, while *D. micracanthus* and **D. didymophyllus** the most frequent. The last-mentioned was regarded as endemic in the Peninsula, but it is shown here to occur also in Borneo. It was confused by Merrill with *D. periacanthus* Miq., a non-resiniferous species. The Bornean species **D. sparsiflorus** and its **var.**

* I am indebted to the Director of the Forest Research Institute, Kepong, Malay Peninsula, for the loan of the material.

**sarawakensis** do not belong to the RESINIFERAE, among which it was placed by Beccari. *D. verticillaris* is shown to be a species endemic in the Peninsula, previous records for its occurrence in Borneo being based apparently on misindentified specimens of **D. acamptostachys,** a species that appears to be very akin to *D. floridus.* What appears to be **D. annulatus**—a species hitherto known only from Borneo—has been found to be abundant along the banks of Sungei Kayu Ara in Johore, but both the Bornean and the Peninsular material so far collected lack reproductive parts to enable one to decide the status or the affinities of the species. The typical *D. elongatus* (a Bornean species) has not been found in the Peninsula, all the peninsular specimens that were previously referred to this being either **D. Kunstleri** or its **var. langkawiensis.** The latter is a very variable species with regard to the number of longitudinal rows into which the scales are arranged on the fruits. A similar variation is also noticed in **D. vagans,** which is possibly a senile form of *D. Kunstleri.* It is shown that Ridley's record for *D. scapigerus* in the Peninsula is erroneous, though a species very like it occurs both in Borneo and the Peninsula **(D. lasiospathus).** A form of *D. longipes* occurs in Borneo (see my remarks under **D. longipedunculatus**). There is a great deal of variation in this species (*D. longipes*) and so it appears to me that a thorough revision of all the species belonging to its group is badly needed in order to see whether the various forms akin to it should be separated as distinct species or lumped together under *D. longipes* as mere ecologic or varietal forms. For a thorough revision of this group, a series of material specially from the Liu Kiu Islands, Borneo, Bangka, Philippines, etc. wil be needed. A similar revision is also due of the group represented by *D. elongatus* and *D. Kunstleri* as well as of the one represented by *D. oblongus, D. Korthaslii* and *D. hystrix.* I have shown here that it is advisable to keep **D. oligophyllus** separate from *D. sabut* (to which Ridley had reduced the former) until fertile material is found. At present the two species are known from the infertile material only and one notices important distinctions between these two. That they appear to be closely related was noticed by their author himself (Beccari, *l.c. 1911, p. 181–183*). **D. ruptilis** which was described from a specimen collected by Low in an unknown place in Borneo has been found again by Elmer at Tawao in British North Borneo. **D. setigerus** is shown to be an

illegal* binomial based on a mixture of specimens belonging to more than one species.

As said above, all the species treated in this paper belong to the section PIPTOSPATHAE as defined by Beccari in the *Annals of the Royal Botanic Gardens, Calcutta* (cited hereafter as *Calcutta Annals* or merely *Calc. Ann.*) XII, 1911. I am not sure that the two sections, CYMBOSPATHAE and PIPTOSPATHAE, into which Beccari has divided the genus are very natural; for the specimens of the first section having a long peduncle (e.g. *D. imbellis* and *D. Scortechinii*) are separated with difficulty from the species of the second section having a very much abbreviated fertile part (e.g. *D. lasiospathus, D. scapigerus* and *D. brachystachys*). Further Beccari has subdivided the section PIPTOSPATHÆ in a way that the species like *D. geniculatus* and *D. verticillaris*, which have a long external spathe enclosing, before anthesis, the entire inflorescence including the subprimary spathes, are placed very far apart from the ones which have similar outermost "universal" spathes simply because these latter are not provided with annular rings or collars on their leaf-sheaths (e.g. *D. Sarasinorum*). Further, these species having the "universal" spathes much longer than the internal ones resemble in their spathe characters some of those now placed under CYMBOSPATHÆ (e.g. *D. melanochaetes* and *D. Jenkinsianus*). By drawing the attention of readers to these facts I do not wish it to be understood that I am in disagreement with the sections and the subsections into which the genus *Daemonorops* has been divided. Beccari had to do the best with the scanty material placed at his disposal by the various herbaria to which he

* I use the word illegal on purpose; for the name is valid in the sense that it will have to be listed in such books as *Index Kewensis* and that its publication has once for all prevented making its legal use for any other species. (e.g. A homonym is a valid binomial, though illegal). An invalid name, on the other hand, is such that no botanist need take any notice of it and does not preclude one from making valid and legal use of it for a new species. (In this category come all *nomina nuda* and all binomials that after 1935 are published without any diagnosis in Latin. They should not be listed in *Index Kewensis*). Now the question comes whether one could legally use the trivial name of a valid, but illegal, binomial in a new combination when the binomial is the oldest validly published name for a species, and when the new combination does not produce either a new homonym or a duplication of the generic name? Formerly strict supporters of the priority rule adopted the trivial names of a homonym if the latter was the oldest valid name for the species, but, nowadays owing to a tendency of confusing legality of a binomial with its validity, there are botanists who strongly object to the use of trivial names of valid homonyms in making new combination, whether the homonyms have a priority claim or not. There is therefore a need for definite legislative measures to make this point quite clear and not a matter for individual opinion.

had appealed for specimens, and great credit is due him for restoring order where previously there was nothing but chaos and confusion. But as said in my previous paper (*Gard. Bull.* VIII, p. 242–243) there is a great need for making more perfect specimens than the ones previously made, and it is to prove the necessity of this that I have pointed out what appear to be flaws in the sections and the subsections of the genus *Daemonorops*, since it is only a study based on a series of good specimens that can throw further light on this matter. In addition to the usual parts, it is absolutely necessary that collectors make it a point to include in the specimens of *Daemonorops* the leaf-sheath (possibly the entire sheath when it is armed with annular rings) and the outermost spathe which falls off easily at the time of anthesis of the inflorescence. Should forest departments depute properly instructed collectors to the places where coupes are being felled or openings are being made in a forest for the purpose of road-construction or of extraction of certain commercial timbers, much valuable material can be collected which otherwise is obtained with great difficulty; for the long climbing rattans usually flower and fruit when they reach the tops of tall trees, and in a thick forest it is often not possible to bring down a rattan without felling several trees.

1. **Dæmonorops acamptostachys** Becc. in Calc. Ann. XII (1911) 209 pl. 96.

*D. verticillaris* Mart. *sensu* Ridl. Mat. Fl. Malay. Pen. II (1907) 186 et Fl. Malay. Penin. V (1925) 45 quoad specimina borneensia; Merr. Bibliogr. Enum. Bornean Pl. (1921) 82 **syn. nov.**.

Borneo: **female:** Matang (Ridley, 12395, the Type); Kuching (Ridley, 12409; Shelford, vern. name *Daun Wi*). **Male:** Sarawak (Shelford, male and female mounted on the same sheet); Kuching (Hewitt; Sahib).

The species appears to be erect or semi-scandent, for, though the leaf-rachis bears strong, stout digitate claws on the dorsal side, the cirrus is small or rudimentary. Ridley's n. 12409 is accompanied by a petiole of a radical leaf which indicates that this rattan is tufted. The petiole is fugaceously furfuraceous and armed along the margins with long solitary or digitate spines. The primary spathes are narrowly lanceolate-cymbiform, acuminate, unicarinate, covered with deciduous rusty scurf on the outside, the lower spathes being scantily armed along the carina with solitary, distant, slender spines. The male flowers are pectinate as in *D. geniculatus* and *D. verticillaris*, a probable reason why Ridley confused this species with *D. verticillaris* and extended the distribution of the latter from the Malay

Peninsula to Borneo. The fruiting perianth is explanate but it withers away gradually until a small callosity (1–2 mm. long) remains on the fruit. The fruit scales are arranged in 15 vertical rows.

In the female flowers of one spadix in a duplicate of the type preserved in the Singapore Herbarium (Ridley 12395), the spathels are unusually enlarged so as to obscure the length of involucrophores. But another spadix from the same collection and the one collected by Shelford both show that this enlargement of the spathels is not normal and that the involucrophore could be much longer than hitherto described. This fact and the close resemblance of the leaflets of *D. acamptostachys* to those of *D. floridus* incline me to suspect that the latter species may be conspecific with the former. No doubt in *D. floridus* the leaflets are described as being grouped, but Beccari stated this after seeing only a terminal portion of a leaf. It is a known fact that in many leaves which have equidistant or subequidistant leaflets, but which end in a long cirrus, the leaflets become so disarranged in the terminal parts of the leaves as to give a mistaken impression that they are also so arranged in the lower parts of the lamina; and the terminal portions of the leaves of *D. acamptostachys* there is also a tendency for the leaflets to become disarranged. The only thing that makes one want to see more specimens of these two species before coming to a definite conclusion over the status of *D. floridus* is that its spadix is unusually long and that its leaves have a rather long cirrus.

2. **Dæmonorops annulatus** Becc. in Rec. Bot. Surv. Ind. II (1902) 227 et in Calc. Ann. XII (1911) 174 pl. 72.

Malay Peninsula: *Johore*, Sungei Kayu Ara, at 12½ mile Mawai-Jemaluang Road (Corner & Furtado, 29485; & 29486).

The above cited specimens (both taken from the same tuft to show the difference in the armature of the leaf sheaths of its juvenile and adult forms) appear to belong here, though the species has never been recorded before in the Peninsula, the type having been collected in Borneo. The younger stages are provided with long criniform bristles on the annular crests and resemble very much *D. mirabilis* var. *oligocyclis* Becc., a variety described from a specimen cultivated in Buitenzorg Botanical Gardens. The species grows in tufts and is very frequent in the dense forests along the Sungei Kayu Ara, though not a single plant was noticed with flowers or fruits.

**3. Dæmonorops brachystachys** Furtado **spec. nov.**

*D. propinquus* Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 quoad fructus ac foliola in nota (?); Ridl. Mat. Fl. Malay Pen. II (1907) 181 quoad specimen a Wrayio sub n. 3658 lectum, et Fl. Mal. Pen. V (1925) 41 quoad specimen kelantanense infra citatum. **Plate 37.**

*Caudex* scandens vel semi-scandens, robustus. Frondium *vagina* partim tantum visa, modo petioli armata ut videtur. *Petiolus* (frondium radicalium?) elongatus, 20 cm. superans, aculeis magnitudine variabilibus præditus; maximis ad 7 cm. longis, basi 4 mm. latis, apice acutis, subulatis, minimis 1 cm. longis vel interdum brevioribus, inter alteros sitis, deciduis (?), criniformibus; omnibus solitariis, perraro basi confluentibus. *Lamina* in cirrhum brevem vel rudimentarium terminata, secus rhacheos dorsum unguibus 1–3–fidis reflexis armata. *Segmenta* numerosa, inæquidistantia, alternantia vel sub-opposita, 4 cm. vel ultra inter se dissita, elliptico-lanceolata, sæpe apicem quam basin versus magis attenuata, maxime latitudine ad mediam vel infra sita, apice subito acuminata, subulata, basi abrupte contracta, plicatula, supra secus tres costas prominentissimas et subtus ad costam mediam remote spinulosa, 35–60 cm. longa, 3–5 cm. lata. *Spadix foemineus:* pedunculo ancipite 10–25 cm. longo, ad 1 cm. lato, 0.5 cm. crasso, secus margines et in latere superiore applanato aculeis digitatis vel non, ad 2 cm. longis valde armato, in latere inferiore convexo parcissime armato vel non; parte rhacheos terminali fructifera circ. 5–8 cm. longa; basali infertili ad 8 cm. longa; ambobus rhacheos partibus conjuncte pedunculo fere æquilongis vel brevioribus. *Rami* primarii 2, spiculiferi, spiculis ad 3 cm. longis, fructus ad 6 gerentibus. *Spathae* primariæ ignotæ; spathellæ annulares, apice in ligulam triangularem productæ. *Involucrophorum* breve, ex spathellis paulo exsertum; involucrum obconicum, in cratera illius fere omnino immersum, apice prateriforme; areola latitudine sua æquilonga vel brevior. *Perianthium* fructiferum explanatum. *Fructus* oblongo-ellipticus, utrinque attenuatus, sine mucrone apicali ad 2 mm. alto et 3–fido 2.5 cm. longus, 1.8–2 cm. in diam., maxima latitudine ad mediam vel fere sita. *Squamae* secus mediam canaliculatæ, per orthostichos 18–20 dispositæ, resina atro-sanguinolenta profuse vernicatæ. *Semen* ovoideum, 1.5 cm. 1.3 cm. latum, 1.2 cm. crassum.

*Planta mascula* habitu sicut fœminea ut videtur. *Spadix masculus:* rhachis fertilis tantum visa, 40 cm. longa,

**Dæmonorops brachystachys** Furtado. Type.

in ramos 9, ad 7 cm. longos divisa; rami secundarii plures, graciles, spiculas numerosas gerentes; spicularum axis ramis secundariis similis, gracilior. *Corolla* 4 mm. longa, striata, calyce multototies longior.

MALAY PENINSULA: **Female:** *Kelantan:* Sungei Keteh at Batu Papan (Nur with Foxworthy, 12076, vern. name *Atap Chuchur*. Type in Singapore). *Perak,* Upper Perak at 300 feet alt. (Wray, 3658). **Male:** *Selangor:* Semenyih (Hume, 8113).

Leaflets in Wray's specimens are apparently from radical leaves.

This species appears to be related to *D. draco* as interpreted by Beccari in that the leaflets have three nerves bristly in the upper surface (the midrib only in its terminal portion) and the fruits are somewhat elliptic pyriform. The leaf-sheath and the petiole described above appear to belong to the basal leaves and hence are not comparable in any way to the corresponding parts of the leaves growing in the higher regions; but judging from the analogy in some other species studied by me, the normal leaf-sheath does not appear to belong to the class having deciduous, acicular spines which are one of the characteristics of *D. draco*. The Javanese species, *D. ruber,* which is also described to have 3 bristly nerves in the upper surface of the leaflets differs from this in its spherical and sparingly resiniferous fruits and longer spadices. *D. propinquus* which has been confused with this species has ovoid fruits which are much broader towards the base and have lighter coloured scales and resin. Its leaflets has only the median costa bristly above. (See also my remarks on *D. propinquus*).

**4. Dæmonorops calothyrsus** Furtado **spec. nov.**

*D. longipedunculato* infra descripto affinissima, sed aculeis ad vaginarum apicem longioribus ac pluribus; petiolis basin versus magis armatis, aculeis frequenter longioribus; spicularum rhachi crassiore; involucrophoris longioribus crassioribusque; fructibus longioribus, pro rata angustioribus, utrinque minus rotundatis, apice longius rostratis; squamis per orthostichos 12 dispositis hæc species bene distincta.

*Caudex* scandens vel semi-scandens, ad 6 m. longus. *Frondes* longipetiolatæ, cirrhiferæ, cum petiolo cirrhoque 1.5–4 m. longæ, dorso secus rhachen unguiculatæ. *Vagina* haud gibosa, ut in *D. longipedunculato* armata sed aculeis præsertim ad apicem sæpius longioribus, ad 10 cm. longis. *Segmenta* per greges utrinsecus 8–12, sub-oppositos

vel alternantes, singulos ex 2–5 constatos approximata, 35–45 cm. longa, 3 cm. lata, subtus ad costam mediam remote spinulosa, supra inermia vel in quarta parte terminali ad eamdem costam remotius aculeolata, secus margines spinulosa, venulis tranversis conspicuis. *Spadix foemineus* (sine pedunculo ?) 40–50 cm. longus; pedunculo ancipiti; ramis primariis 3–5, spiculiferis, 15–18 cm. longis; spiculis axi sinuosis, ad 8 cm. longis, tomentosis flores utrinsecus 5–6 gerentibus. *Involucrophorum* floriferum ad 2–4 mm. longum; fructiferum 5–7 mm. longum, cum involucro perianthioque 10 mm. longum. *Fructus* cum perianthio cyathiforme-campanulato 2–3 mm. et rostello 2.5–4 mm. alto 26–28 mm. longus, 12–13 mm. in diam; squamis per orthostichos 12 loricatis. *Semen* 16 mm. altum, 8–9 mm. latum, 7–8 mm. crassum; embryone subbasilari.

*Spadix masculus* paniculatus, decidue fusco-furfuraceus; pedunculo longo, ancipiti. *Spathae* primariæ papyraceæ, exsuccæ, cinnamomeæ, extus furfureo fugaceo fuscæ, inermes; externa longissima, acuminata, bicarinata; spathellæ annulares. *Rami:* primarii circ. 20 cm. longi; secundarii 6–7 cm. longi, spiculiferi; *Spiculae* 2–4 cm. longæ, axi sinuosæ, floribus untrinsecus 3–6.

BRITISH NORTH BORNEO: Kinabalu Mountains at Tenompok, alt. 4,000–5,000 feet (legit Furtado, comm. Clemens sub. n. 29194, female, Type in Singapore; and n. 29193, male).

Found growing in secondary jungle. My field notes say that the spadix is 40–50 cm. long, but I am not sure whether the peduncle was included in the measurements.

The species is at once distinguished from all the others belonging to *D. longipes* group by its fruits, which are, even in their younger stages, long and narrow, having their fruit-scales in 12 rows. The leaflets are almost bare above except for a small terminal portion which is spinulose along the midrib.

*D. sabensis* (collected in the lower regions of the Kinabalu Mountains) which from the description appears to belong also to this group, is said to have a very short petiole and a male inflorescence with funnel-shaped spathels and with the male flowers arranged as in *D. longispathus* and not as in *D. longipes.* The leaflets are described to be sparingly armed along the three nerves beneath. (The female plant is unknown).

From *D. periacanthus* it is easily distinguished by its unarmed (or occasionally sparingly armed) peduncle, fruits which are nearly twice as long as broad (not spherical),

**Dæmonorops confusus** Furtado. Type.

fruit-scales arranged in 12 (not 15–16) vertical series, by its leaf-sheaths which show no gibbosity below the petiole and which have very few small laminar or criniform bristles, and by its leaflets which have a midrib usually armed for the greater part in the lower, and only a small terminal portion in the upper, surface.

**5. Dæmonorops confusus** Furtado **spec. nov.**

*D. propinquus* Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 et in Calc. Ann. XII (1911) 111 quoad specimen sumatrense a Forbesio lectum et in Tabula 45 depictum?

*D. draco* Willd. *sensu* Bl. Rumphia (1845) quoad tab. 132? **Plate 38.**

*Caudex* scandens, robustus, cum vagina 2.5–3.5 cm. in diam. ut videtur. Frondis *vagina* infra petiolum gibbosa, aculeis inæquialtis: longissimis paucis, robustis, ad 3 cm. longis, elasticis, plus minusve deflexis, laminaribus, sæpe laciniatis, plerumque solitariis, e basi latis apicem versus angustatis, summo subulatis; alteris multototies brevioribus, consimilibus, plurimis, inter priores positis, solitariis vel interdum confluentibus armatissima. *Petiolus* supra applanatus, aculeis ad 1.5 cm. longis, solitariis vel basin versus transverse confluentibus armatus, subtus convexus, aculeis paucioribus plerumque solitariis. *Lamina* magna, in cirrhum longum unguibus ad 7–fidis armatum transiens; ad rhacheos dorsum unguibus 1–3–fidis, reflexis prædita, supra parce aculeolata. *Segmenta* numerosa, subæquidistantia, alternantia vel subopposita, in parte terminali in greges ex segmentis binis vel pluribus sæpe approximata, plicatula, elliptico-lanceolata, utrinque subito attenuata, secus costam mediam utrinque parce aculeolata, subtus pallidiora, secus margines spinulosa, apice longe acuta vel acuminata, setosa, venis transversis indistinctis, 2–3.5, interdum 5.5 cm. inter se dissita, 25–35 cm. longa, 2 cm. lata. *Spadix foemineus* fructiferus tantum visus, cum pedunculo ancipiti 5 cm. longo secus margines armato 50 cm. longus. *Spathae* primariae ignotæ, spathellis perbrevibus annularibus apice liguliformibus. *Rami* primarii circ. 5, in spiculas alternantes ad 5 cm. longas divisi. *Involucrophorum* tri- vel quadrangulare, pedicelliforme, clavatum, 1 cm. longum. *Involucrum* 2–4 mm. longum, obconicum, apice truncatum ad 5 mm. in diam., vertice concavum; areola oblonga involucrophoro fere æquilonga. *Perianthium* fructiferum explanatum. *Fructus* oblongus, longe mucronulatus, sine mucrone 2–3 mm. alto circ. 20–22 mm. longus, 17–19 mm. in diam., squamis secus mediam canaliculatis, per series verticales 18–20 imbricatis, resina atro-purpurea vernicosis. *Semen* ovoideum, profunde ruminatum, 1.3 mm. longum, 1.2 mm. in diam.; embryone basilari.

SUMATRA: Bandar Baru on Gunong Sibayak (Nur 7308. Type in Singapore).

The photographic plate 45 in the *Calcutta Annals XII* represents a Sumatran plant collected by Forbes under n. 2287 and preserved in the Calcutta herbarium. Beccari has identified it as *D. propinquus*, from which it differs in several characters; for, to quote from my notes made of the duplicate preserved at Kew, the leaflets in it may be described as elliptic lanceolate, while in *D. propinquus* they are much longer (40–45 cm.), broader (2–3.5 cm.), ensiform, gradually narrowing towards the apex. The involucrophore in Forbes's specimen is much longer than in the type of *D. propinquus*. The outer spathe shows slender spines, solitary or in groups, mostly along the two dorsal carinæ and margins, without any tendency to align themselves in transverse series, though they may be linked vertically by the fibres of the carinæ and the margins. In Griffith's specimen referred here to *D. propinquus* the outer spathe is much more rigid and woody and has not any prominent dorsal carinæ. Its spines too are often transversely digitate and coalesce sometimes to form interrupted horizontal series.

Forbes's specimen appears to belong to *D. confusus*, though owing to a great difference in the development between its spadix and that of the type of *D. confusus*, and also owing to the absence of the outer spathe in the latter, I cannot be sure of the determination. The leaflets and the armature on the petiole and the sheath agree very well with those in Nur's specimen. I did not have the latter with me at the time I made notes of Forbes's specimen, but looking at Beccari's plate, I note that the peduncle in that of Forbes is armed all round and with more spines, whereas in Nur's it is (very sparingly) armed only along the two margins. But such variations may sometimes be found even in one and the same species.

Blume's plate 132 in *Rumphia* (1845) appears to belong here, though Beccari (*op. cit. p. 107*) was inclined to regard it as the real *D. draco* (Willd.) Bl. According to Beccari's interpretation I take *D. draco* to be a species with small seriate bristles on the sheath (more or less as in *D. dracunculus* Ridl.) and short involucrophores (as in *D. propinquus*). Blume's plate 132 does not in any way satisfy these two conditions. The armature on the outer spathe in the plate appears moreover to be like the one in Forbes's specimen preserved in the Kew Herbarium.

**6. Dæmonorops didymophyllus** Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 468 et Calc. Ann. XII (1911) 123; Ridley in Journ. Roy. Asiat. Soc. Str. Br. (1900) 175, Mat. Fl. Mal. Pen. II (1907) 180 et Fl. Mal. Pen. V (1925) 41.

*D. periacanthus* Miq. *sensu* Merr. in Univ. Calif. Publ. Bot. XV (1929) 24 **syn. nov.**

MALAY PENINSULA: *Singapore:* Selitar (Ridley: in 1890; in 1892, vern. name *Rotang Udang;* in 1894 n. 6277); Chan Chu Kang (Ridley, 3476, v.n. *R. Udang*); Bukit Timah (Ridley: in 1892, v.n. *R. Butong.* "The poisonous rattan, used by the Sakais"; in 1895, v.n. *R. Getah;* and 5875 and 6672); Changi (Ridley 6273; Mat in 1894); Bukit Mandai (Ridley, 10437). *Johore:* Pulau Tinggi (Burkill, 928, v.n. *R. Tawa*); Sungei Pelapa (Nur, 20045); Gunong Banang (Ridley in Nov. 1900); Mt. Austin (Ridley in June 1904); Tanjong Kopang (Ridley, 6285). *Selangor:* Bukit Enggang (Symington, 24207, vern. n. *R. Kambong*); Kepong Plantations (Junas, 16403, vern. n. *R. Mantang*); Rawang (Ridley, 7885, vern. n. *R. Tahi Ayam*). *Pahang:* Tembeling (Henderson, 24532). *Kelantan:* Sungei Keteh at Batu Panjang (Nur with Foxworthy, 12113, v.n. *R. Saga*); *Perak:* Taiping Hills (Ridley in Feb. 1904); Maxwells Hill (Burkill & Haniff, 12681); Tapah (Burkill & Haniff, 13450); Jor (Haniff, 14231, Sakai name is *Gum Chebor*). *Penang,* Penang Hill (Ridley, 10345).

BORNEO: Tawao (Elmer 20482); Quop (Hewitt, in March 1908); Matang (Ridley in 1903, and n. 11823); Puah (Ridley, 12408).

In his *Flora,* Ridley has referred to *D. propinquus* Becc. the specimen collected by Burkill and Haniff at Tapah under n. 13450. Merrill *op. cit.* has referred Elmer's specimen to *D. periacanthus* Miq. with a proviso that it does not agree "particularly well" with Beccari's plates 88–89 given in the *Calcutta Annals* and that it "may prove to represent a distinct species". The Bornean specimens collected by Hewitt and Ridley show a great deal of variation from the type, but in the absence of better material I am averse to separate them into varieties. These variations incline me to regard *D. Motleyi* Becc. as a mere variety of *D. didymophyllus.*

**7. Dæmonorops Kunstleri** Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 469 et Calc. Ann. XII (1911) 151, t. 61; Ridl. Fl. Malay Pen. V (1925) 43.

*D. elongatus* Bl. *sensu* Ridl. Mat. Fl. Malay. Pen. II (1907) 185, in Journ. Roy. Asiat. Soc. Str. Br. 59 (1911) 215 et Fl. Mal. Pen. V (1925) 43. **syn. nov.**

MALAY PENINSULA: (*a*) *Fruit scales arranged in 15 vertical series: Pahang*, Sempadam, near Gap (Burn-Murdoch, 13297); Fraser's Hill (Holttum, 21526). *Selangor*, Bukit Kutu (Ridley in May 1896); Semangok (Ridley in Aug. 1904); Kwang (Ridley, 13451). *Negri Sembilan*, Bukit Tangga (Nur, 11853); Gunong Angsi (Nur, 11671). *Johore*, Temeoh River near Kota Tinggi (Ridley, 15361); Gunong Bechua (Holttum, 10839).

(*b*) *Scales in 15–17 series. Kedah*, Gunong Jerai = Kedah Peak (Ridley in June 1893). *Penang*, Penang Hill (Ridley, 10343); Balik Pulau (Ridley, 7905). *Johore*, Kuala Tebrau (Mat in June 1892); Gunong Belumut (Holttum, 10610; & 10748 ?); Kluang (Holttum, 9257). *Singapore*, Chan Chu Kang (Ridley in Oct. 1889); Bukit Mandai (Ridley in 1909); Bukit Timah (flrs., Ridley in 1894).

(*c*) *Fruit scales in 16–18 series. Penang*, Government Hill (Curtis, 2150); Mount Elvira (Haniff in April 1901). *Perak*, Larut Hills (Ridley in Dec. 1902). *Pahang*, Wray's Camp in Tahan (Ridley, 16291). *Dindings*, Bruas (Curtis Dec. 1903, v.n. Rotan Dudok). *Johore*, Mount Austen (Ridley in 1909). *Singapore*, Chan Chu Kang (Goodenough, 1667*); N. Seletar (Ridley in Dec. in 1890).

From the above classification of the specimens it will be readily seen that the species is very variable regarding the number of vertical rows into which the scales are arranged on the fruits.

Possibly this and *D. vagans* represent varieties of *D. elongatus* Bl., but the typical form of *D. elongatus* does not occur in the Malay Peninsula. Ridley's specimen n. 7905 collected at Balik Pulau in Penang was doubtfully referred by Beccari (*l.c. 1911, p. 141*) to *D. elongatus* and was said to have fruit-scales arranged in 18 vertical rows. A duplicate in the Singapore herbarium has its fruit-scales arranged only in 15–16 orthostichies. The lowermost spathe is also much smaller than in the typical *D. elongatus* and is like that of the typical *D. Kunstleri* though the leaflets are inequidistant in the terminal portion of the leaf; but this condition, I believe, is due to the fact that the cirrus is well developed as it often happens in many specimens of *D. Kunstleri*.

**7A. Var. langkawiensis** Furtado **var. nov.**

*D. elongatus* Bl. *sensu* Ridl. in Journ. Roy. Asiat. Soc. Str. Br. 59 (1911) 215; Ridl. Fl. Mal. Pen. V (1925) 43 quoad specimen ab Haniffio lectum.

* This number is also given to a specimen collected by Goodenough at Kranji. The spadix of this latter specimen is of *D. hystrix*.

A forma typica differt foliolis remotioribus, fructus squamis per orthostichos 20 dispositis.

MALAY PENINSULA: *Langkawi Island*, Gunong Raya (Haniff & Nur, 7119); Kesap (Haniff, 15911, v.n. Rotan Jeren); Burau (Ridley, 15884). On the last mentioned specimen is also mounted a spadix of *D. hystrix*.

**8. Dæmonorops lasiospathus** Furtado **spec. nov.**

*D. scapigerus* Becc. *sensu* Ridl. Flor. Malay. Pen. V (1925) 43 p.p. ?.

*Caudex* erectus, 0.5–1.5 m. altus, solitarius. Frondium *vagina* apice oblique truncata, haud gibbosa, fugaceo-leprosa, spinis applanatis gramineis, per series subparallelas obliquas confluentibus, 1–2.5 cm. longis armata. *Petiolus* 35–40 cm. longus, 8–12 mm. latus primum fusco-leprosus, dein glabrus, gramineus, supra applanatus basin versus late canaliculatus; dorso convexus; ad margines obtusas spinis ad 6 cm. longis, gramineis, applanatis, plerumque ternatis (digitis divaricatis, duobus dorsum versus enatis quam tertio multo brevioribus) armatus. *Lamina* metralis, plerumque cirrho carens vel in cirrhum filiformem ad 6 cm. longum terminata, unguibus simplicibus vel bifidis per series duas ad margines rhacheos dorsales prædita, in parte apicale sæpe carentibus. *Segmenta* plura, equidistantia, 2–3 cm. inter se remota, ensiformia vel lanceolato-lineraria, 25–30 cm. longa, 18–20 mm. lata, utrinque attenuata, in acumen longum oblique contracta, ad margines spinulosa, spinis apicem versus valde confertis; supra conspicue 3–costulata, viridia, secus costam mediam apicem versus tantum remote spinulosa, costis ceteris inermibus; subtus pallidiora, 5–leptoneura, ad totam costam medianam setulis inter se 2–4 mm. dissitis, ad costas ceteras setulis inter se 5–10 mm. vel magis remotis conspicue armata. *Spadices foeminei:* pedunculus magnitudine variabilis, 30–55 cm. longus, applanatus, biconvexus vel obscure triangularis, indumento ferrugineo deciduo obtectus, rarissime inermis, plerumque aculeis ad 2.5 cm. longis, solitariis vel digitatis, acicularibus vel applanatis, basin versus longioribus ac sparsioribus, superne minoribus ac magis confertis, interdum basi confluentibus armatus; *pars florifera* 5–15 cm. longa, in 3–5 ramos primarios floriferos vel spiculigeros, ad 5 cm. longos, indumento ferrugineo deciduo obtectos divisa. *Spiculae* 10–15 mm. longæ, floribus 3–5 confertis. *Sapathae: primariae* membranaceæ, exsuccosæ, scaphoideæ, ad 15 cm. longæ, post anthesin deciduæ, trichomis sericanis, ad 2 cm. longis, herbaceis, plus minusve appressis, per series transversales dispositis præditæ, inter quas indumento ferrugineo deciduo obtectæ; *secundariae* circ. 1 cm. longæ, inermes, fugaceo

tomentosæ, membranaceæ, basi amplectantes, apice acuminatissimæ. *Spathellae* annulares, oblique truncatæ vel in uno latere in ligulam triangularem productæ, basi tomentosæ. *Involucrophorum* sessile, cupuliforme, in spathella immersum vel paululo exsertum. *Involucrum* consimile. *Flores* 1 cm. longi; calyx 5 mm. longus, profunde tripartitus; corolla calyce duplo longior, fere ad basin tripartita, segmentis lanceolato triangularibus, coriaceis. *Perianthium fructiferum* explanatum, apice mox emoriens, basi 2–4 mm. longum, callosum. *Fructus* sphærici vel globosi, 2.5 cm. in diam., in apiculum conicum ad 4 mm. longum abrupte terminati, squamis per series verticales 13–15 dispositis, basi gramineis, apicem versus atro-fuscis, secus margines conspicue atro-cinctis, dorso sulcatis. *Semen* cum integumento sicco ambitu oblongum, 17–19 mm. altum, 16–17 mm. crassum, utrinque truncatum, basi caudiculatum; sine integumento globoso ovoideum, obscure quadrangulare, 17–18 mm. altum, 15–17 mm. latum, 15–16 mm. crassum, basi rotundato-truncatum, apice paulo atttenuatum, summo rotundatum. *Albumen* profunde ruminatum; parte centrale homogenea et alba circ. 5 mm. in diam. *Embryo* basilaris.

*Planta mascula* habitu ut fœminea, sed spadicum parte spiculigera spiculisque longioribus, pedunculo minus armato, floribus angustioribus differt. *Flores* 6–8 mm. longi, calyce 2–4 mm. longo, duplo breviore quam corolla.

MALAY PENINSULA: *Johore*, Sungei Kayu Ara, 12½ mile Mawai-Jemaluang Road, common in moist, shady forest along the river banks (Corner & Furtado, 29482-A, female plant. Type in Singapore; 29494, male plant); Ulu Kahang (Holttum, 10920).

BORNEO: Siul (Ridley, in Sept. 1905); Matang (Ridley, in July 1903 or 1905 ?).

This species is a very close ally of *D. scapigerus* Becc., but that is described to have spathes which are quite unarmed or smooth and leaflets which are larger and more distantly arranged on the leaf rachis and which moreover bear in their under surface bristles along the median costa only, the other ribs being quite bare. In *D. lasiospathus*, on the other hand, the primary spathes bear transverse rows of long, silky, soft herbaceous spines or hairs, and the three to five ribs, of the leaflets are conspicuously spinuliferous in the under surface.

The seeds in *D. lasiospathus* are globose-ovoid, provided with a broad superficial furrow that runs longitudinally from the base to the apex and then across the other side to the base. It is this furrow that gives the seeds an

appearance of being obscurely quadrangular. The mucilaginous coating of the seeds is rather thick when fresh and has acidulous pleasant taste. The fruit-scales vary considerably in colour; sometimes they are dark brown with a still darker line along the margins and a straw-coloured line at the base; at other times, or on other side of the same fruit, the scales are mostly yellowish or straw-coloured, the dark colour being restricted only to the apex and the margins.

I have seen only two male specimens (Corner & Furtado, 29494) and in both these the peduncles are considerably less spiny than in the female, though they do not exhibit any other character to separate them from the typical specimens. Hence I doubt the advisability in using the spininess of the peduncle as a basis for splitting the species of this group into varieties as Beccari has done in the case of *D. scapigerus* Becc. and its *var. minor* Becc. I have therefore included in the above citations Ridley's specimen (female) collected at Matang in Borneo, though its peduncle is quite unarmed.

I am not sure what specimen is referred by Ridley in his *Flora* to *D. scapigerus* Becc. The description given is mostly adapted from the one given by Beccari in the *Calcutta Annals XII.* The specimen is quoted thus: "Johore, Ulu Madik, (Holttum)". Now the Ulu Madik specimen is numbered 10636 and bears not the slightest resemblance to *D. scapigerus*, though in the Singapore herbarium it is marked to show that it is the basis for Ridley's record of *D. scapigerus* in the Malay Peninsula. It is a typical *D. periacanthus* Miq. At Ulu Kahang, a region not far distant from Ulu Madik, Holttum collected another specimen which is referred here to *D. lasiospathus* (cf. Holttum, 10920). Possibly Ridley had this second specimen in mind when he recorded *D. scapigerus* for the Peninsula.

**9. Dæmonorops longipedunculatus** Furtado **spec. nov.**

*Caudex* scandens vel semi-scandens, 1.5–5 m. longus, cum vagina 2.5 cm. in diam. *Frondes* magnae, cirrhiferae, subtus ad rhachin laminæ trigonam unguibus 3–5 fidis et ad cirrhum 5–7–fidis. *Vagina* in speciminibus visis haud gibbosa, allutacea, aculeis laminaribus, elasticis, solitariis vel interdum per series tranversas interruptas confluentibus olivaceis vel nigricantibus, reflexis, ad 8 cm. longis, basi 4–6 mm. latis, majoribus et brevioribus immixtis, frequenter apicem versus longissimis, inferioribus latissimis et infimis

brevissimis armata. *Ochrea* perbrevis, spinulis acicularibus fusco-atris per series tranversas aggregatis, ad 4 mm. longis ad marginem extus armata. *Petiolus* circ. 25–75 cm. longus; supra late canaliculatus vel applanatus, basin versus interdum aculeis rigidis solitariis vel confluentibus; subtus convexus, dorso aculeis solitariis rigidis, remotis; ad margines obtusus aculeis basin versus interdum laminaribus, elasticis, longioribus perpaucis, ad 5 cm. longis, brevioribus rigidis immixtis, apicem versus valde reductis armatus. *Segmenta* per greges approximata, gregibus alternantibus vel sub-oppositis ex segmentis 2–4 constatis, coriacea, elliptico-lanceolata, utrinque sensim vel abrupte attenuata, in apicem filiformem facile emorientem terminata, basi subito contracta; 5–7 plicatulo-costulata, 30–50 cm. longa, 2.5–4.5 cm. lata, supra saturate viridia, subtus pallidiora, secus costam mediam in parte terminali utrinque et remote aculeolata vel in uno latere inermia, ad margines aculeolis consimilibus sed brevioribus, apicem versus longioribus et magis confertis ciliata, venulis tranversis plurimis utrinque conspicuis. *Spadix foemineus* longi-pedunculatus, paniculatus: pedunculo ad 1 m. longo ancipiti, inermi vel ad margines aculeis acicularibus perpaucis remotis prædito, decidue fusco-leproso; rhachi florifera circ. 40 cm. longa, in ramos 3–5 divisa; ramis ad axillam callosis, alternis, fugaceo fusco-tomentosis, 10–20 cm. longis, utrinsecus spiculas 4–6 ferentibus; spiculis sinuosis utrinsecus 5–6 fructus gerentibus, eodemmodo tomentosis. *Spathae* primariæ ignotæ; spathellæ ut rhachis spicularum fusco-tomentosæ, annulares. *Involucrophorum* fructiferum, obconicum, pedicelliforme, obscure-angulare, 2–4 mm. longum, ad axillam conspicue callosum; involucrum in involucrophoro fere omnino immersum vel ad 1 mm. exsertum, patellæforme, integrum, orbiculare vel floris latus neutri versus magis productum, vertice cicatrulla orbiculari plus minusve tumida præditum; areola conspicua, altitudine sua latiore, cicatrulla tumescente. *Flores:* calyx floriferus urceolatus vel cyathiformis, apice obscure trifidus; corolla calyce duplo longior, segmentis longis mox emorientibus. *Perianthium* frunctiferum manifesto pedicelliformme, in parte basilari cyathiforme, apice segmentis explanatis. *Fructus* oblongi, utrinque abrupte et rotundato contracti, cum perianthio ac rostello utroque 2–3 mm. alto circ. 20–25 mm. longi, 13–15 mm. in diam. *Squamae* in orthostichis 15, rarius 16–17, dispositæ, medio sulcatæ, fusco-stramineæ, ad margines scariosæ, fascia intramarginali fusca vel leviter

purpurea (ad angulum inferiorem atriore) cinctæ. *Semen* oblongum, utrinque rotundatum, in uno latere applanatum, 15–17 mm. longum, 10–11 mm. latum, 9 mm. crassum; embryone basilari; albumine ruminato.

*Planta mascula* habitu sicut fœminea ut videtur. *Spadix* magnus et longi-pedunculatus; pedunculus anceps; rhachis ut in fœminea divisa et vestita. *Rami* primarii in ramos secundarios spiculas gerentes 3–4 divisi. *Spathae primariae* papyraceæ, exsuccæ, cinnamomeæ, extus indumento fusco fugaceo obtectæ, striatæ, inermes; externa longissima, circ. 30–40 cm. longa, bicarinata, apice sæpe fissa, acuminata. *Spiculae* 2–5 cm. longæ, porrectæ, sinuosæ, utrinsecus floribus bifariis 4–6 congestis. *Flores* 5 mm. longi; calyce tubuloso, cyathiforme, striato, obscure trifido; corolla striata, fere duplo longiore quam calyce, ad 2/3 in segmenta lanceolata divisa.

BRITISH NORTH BORNEO: Kinabalu Mountain Range: *Penibukan*, alt. 4,000–5,000 feet (Clemens: 31280, type in Singapore; 31280*a*; 30887; 31581; 50343; and 40754, male). *Gurulau Spur*, alt., circ. 5,000 feet (Clemens, 50547). *Dallas*, alt. 2,500–3,000 feet (Clemens: s.n. mature fruits but no leaves; 26793; 26807; 27156–*a*, male, no leaves; 27156; 27269).

The Dallas specimens have involucrophores distinctly longer than in the type and may prove to represent a distinct variety, but in the absence of better material I have refrained from giving them a varietal rank.

This species is very closely related to *D. virescens* from the Philippines and *D. longipes* from the Malay Peninsula and Malay Isles; but it is readily recognised from either of these by its distinctly grouped leaflets which have moreover their midribs (others are bare) sparingly spinulose in one or both surfaces, whereas in the other two species the leaflets are not distinctly grouped except perhaps in the lowermost and the uppermost part of the lamina. They (the leaflets) are also much more spinulose in the latter two species and often the side nerves (in *D. longipes* in the lower or both surfaces and in *D. virescens* in the upper surface only) also bear bristles. Perhaps *D. virescens* represent a link between *D. longipes* and *D. longipedunculatus*. I have noted that the leaflets are 5–7 nerved because I do not find any difference between subprimary and secondary nerves, though in nervation these leaflets cannot be easily distinguished from those of *D. longipes* except by their armature.

*D. periacanthus* Miq. resembles this species specially with regard to the grouping of the leaflets, but it has: a much shorter peduncle which is conspicuously spiny:

spherical fruits; leaflets with a midrib usually smooth or occasionally armed with a few bristles underneath the apex only; and a leaf-sheath armed with a much larger number of smaller spines and provided with a slight gibbosity below the petiole.

Forms actually much closer to *D. longipes* occur in Borneo as is evidenced by Elmer's no. 20840 collected at Tawao and listed by Merrill in *Univ. Calif. Publ. Bot. XV, 1929, p. 24,* without any specific epithet. Judging from the fragmentary material available in the Singapore herbarium, consisting of a portion of lamina and a pair of fruiting spikelets, I am inclined to think that this Elmer's specimen represents but a mere variety of *D. longipes* with smaller fruits having their scales arranged in 18 vertical rows. The leaflets seem to be inæquidistant and not distinctly grouped and their three costas are armed as in *D. longipes* with the exception that the two subprimary costas above are quite bare, a condition also found occasionally in the other species. Of the other parts which I have not seen, Merrill gives the following description: "The leaves about 3 m. long, flagellate [cirrate], the flattened spiny petiole about 1 m. in length, the spines on the basal sheathing parts flat, nearly black, 5 cm. long, arranged in transverse rows. Infructescences 45 cm. long, pendent, flattened green peduncles 60–90 cm. in length." Perhaps Merrill had no fruits and sufficient leaflets in the specimens examined by him, for he notes that "the material available for study is not sufficient for further identification".

**10. Dæmonorops micracanthus** (Griff.) Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 et in Calc. Ann. XII (1911) 110 pl. 43; Ridl. Mat. Fl. Mal. Pen. II (1907) 180 et Fl. Mal. Pen. V (1925) 41 pp.

*Calamus micracanthus* Griff. in Calc. Journ. Nat. Hist. V (1844) 62 et Palms Brit. Ind. (1850) 72; Mart. Hist. Nat. Palm. III (1849) 339.

*D. draconcellus* Becc., Nelle Foreste di Borneo (1902) 324, 590, 608 et in Calc. Ann. XII (1911) 108 pl. 42; Merr. Bibliogr. Enum. Bornean Pl. (1921) 78. **syn. nov.**

*D. propinquus* Becc. *sensu* Ridl. Mat. Fl. Mal. Pen. II (1907) 181 et Fl. Mal. Pen. V (1925) 41 pp. **syn. nov.**

MALAY PENINSULA: *Kemaman* (Vaughan-Stevens in 1890). *Kedah:* Sungei Petani (Forest Dept. Coll. 10209 in herb. Kepong); Baling (Babjee, 10168 in Herb. Kepong). *Pahang:* Gunong Lesong (Lambak, 10006 in herb. Kepong); Sungei Lepar (Smith 6701 in herb. Kepong. *Negri Sembilan:* Palong Gemas (Hamid, 6380); Kuala Pilah (Moorhouse in 1904, sterile; in 1908, fertile); Bukit

Senaling (Moorhouse in 1903). *Malacca:* (Griffith, sterile, in Kew Herb. *Type*). *Johore:* Johore Lama (= Panchur) (Ridley, 10952, v.n. *Tai Ayam,* sterile). *Singapore:* Bukit Timah (Ridley in 1900, sterile).

BORNEO: Kuching at the foot of Gunong Matang (Beccari, 3644. Type of *D. draconcellus;* only its photographic plate above referred seen).

Here may also belong the following Peninsular specimens: *Selangor:* Kuala Lumpur, at Istagoh (Ridley, in June 1890). *Singapore:* Seletar, (Ridley on 30 Oct. 1889).

The basis of *D. micracanthus* was a sterile (juvenile) specimen sent to Griffith from Malacca, while that of *D. draconcellus* a fertile specimen collected in Borneo. But more mature and complete specimens collected in the Peninsula leave no doubt that the two species are identical. The criniform bristles on the sheath are fugacious so that in the type of *D. draconcellus* they have not yet fallen off. When the plants are very young, the spines grow on small tubercles, but later on, as the plants develop, the tubercles tend to coalesce in interrupted horizontal or oblique series, giving thereby a wrinkled appearance to the sheath. The leaflets are often bristly in the three superior nerves, but in some cases only the midrib is sparingly armed; in the lower surface the bristles appear to be mostly deciduous so that sometimes only a few bristles remain on the midrib and at times a few are also found on the two side nerves. The perianth is explanate in the fruit with a short circular callus at the base. The fruit scales are arranged in 18–21 vertical series. The spadix is covered with a deciduous rusty brown indumentum. The very narrow leaflets, the length of the involucrophore (3–5 mm. long), the callus or perianth ring persisting on the fruits and the rusty brown indumentum on the spadices distinguish this at once from all the other "dragon-blood" producing species in the Peninsula.

Ridley's description of the fruits and spadix, which is framed in mistaken terms, was derived apparently from a specimen collected by him at Bukit Timah in Singapore, sub n. 10783, and cited by him in the *Materials* and his *Flora.* The spathe, spadix and fruits in this specimen are evidently of *D. didymophyllus,* while the leaf is of quite different species (possibly *D. angustifolius*).

The two specimens which I have doubtfully referred here and the one from Kemaman (this last consist of a fruiting spadix only) have been cited by Ridley in his works under *D. propinquus.* The first two specimens have leaflets which are apparently of *D. micracanthus,* with male

spadices resembling those of *D. brachystachys.* The only difference that one notices in the leaflets is that the lower surface of the midribs is more distantly aculeolate than in the female specimens. The spathes, though very powerfully armed, are easily distinguished from those of *D. propinquus* (as figured by Griffith) by their spines which are distinctly digitate in the latter.

With the exceptions noted above, almost all the other collectors have recorded that this species is *Rotang Jernang*—a name which Malays apply rather indiscriminately to all the species yielding "dragon-blood". This species yields perhaps the best "dragon-blood" in the Peninsula.

**11. Dæmonorops oligophyllus** Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 470 et in Calc. Ann. XII (1911) 182 pl. 78.

*D. sabut* Becc. *sensu* Ridl. Fl. Malay Pen. V (1925) 27 tantum quoad synonym. **Syn. nov.**

Ridley considers the type of this species to be but a younger shoot of *D. sabut.* If both these binomials are conspecific, then their characters are certainly not a result of merely age but of ecological differentiations; for, apart from the distinguishing differences noticed by Beccari, it is to be noted that the leaves of *D. oligophyllus,* though bear smaller leaflets, are provided with much longer cirrus than in the type of *D. sabut.*, whereas in younger forms one ought to have expected still shorter cirrus. Hence in the absence of conclusive evidences to unite the two species, I think it is better to maintain them as distinct. A specimen of what appears to be *D. sabut* was collected by Ridley in Johore at Castlewood in June 1909. It bears a longer cirrus than in the type specimen, but otherwise agrees well with the description and plate given by Beccari (*Calc. Ann. XII, 1911, p. 181 pl. 77*).

**12. Dæmonorops propinquus** Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 et Calc. Ann. XII (1911) 111 p.p. et pl. 44; Ridl., Fl. Malay Pen. II (1907) 181 et Fl. Mal. Pen. V (1925) 41 p.p.

*Calamus draco* Willd. *sensu* Griff. in Calc. Journ. Nat. Hist. V (1844) 65 p.p. et Palms Brit. Ind. (1850) 75 quoad sepecimina in pl. 201 A & B delineata.

*D. draco* Bl. *sensu* Mart. Hist. Nat. Palm. III, 2nd. Ed. (1849) 205 p.p.

MALAY PENINSULA: *Malacca?* (Griffith, n. 83, developed spadix in Herb. Kew, subject of Griffith's plate 201-B. lecto-Type.; Griffith, unopened spadix with spathes, subject of plate 201-A). *Perak,* loc. incert., (Scortechini in herb.

Beccari, not seen, figured in the plate 44). *Selangor:* Ayer Kuning (Omar, 9933, vern. name *R. Jernang*); Sungei Buloh (Omar, 9916, v.n. *R. Jernang,* fruits used for dyeing purposes, in Herb. Kepong). *Pahang,* Plangai (Burkill & Haniff, 16792, as *R. Jernang,* fruit eaten and medicine made from it).

Beccari's *D. propinquus* is a *mixtum compositum.* Having satisfied himself that the fruiting spadix in Scortechini's specimens belonged to the same species as the one figured by Griffith in the pl. 201. B, he wished to make its description as complete as possible. The difficulty arose when he regarded Forbes's specimen n. 2287 to be conspecific with Scortechini's; and as the leaflets in Forbes's specimen were somewhat different from those in Scortechini's, strangely enough he concluded that the leaflets in the latter specimen did not belong to the same species as the fruits, at least that is the information recorded in a note by Hooker who edited Beccari's manuscript work on the Palms in the *Flora of the British India.* It is possible that Hooker was mistaken in this statement, for the leaflets in Scortechini's specimen as depicted by Beccari in the plate 44 published in the *Calcutta Annals* has leaflets not 5 cm. broad as stated by Hooker in his note, but only 2.5–3 cm. (as in Omar's 9933) as stated by Beccari in the *Calcutta Annals XII (1911) p. 112.* Besides, Scortechini's collection of this species is not represented in the Kew herbarium and there is instead a specimen collected by Wray sub. n. 3658 (referred by me to *D. brachystachys*), which has leaflets as broad and long as the ones described in the note of Hooker and which bears a slip with information written by Dr. (later Sir) David Prain, then of the Calcutta herbarium, to state that Beccari authenticated the fruits to be exactly as in the type (?) of *D. propinquus* but doubted as to the leaflets belonging to same species or the plant as the fruits. This Wray's specimen is not cited in Hooker's *Flora,* nor in the *Calcutta Annals.* Ridley quoted this specimen under *D. propinquus* in his *Materials II (1907) 181,* but omitted it in the *Flora (1925).*

The Pahang specimen cited above consists only of a spadix with young fruits, but without its peduncle or spathes.

For the principal differences between this and *D. confusus* or *D. brachystachys,* see my observations under the latter two species. As the leaf-sheath of *D. propinquus* is not yet known, its exact affinities remain still doubtful. The leaflets are like those of *D. gracilipes.*

The exact locality whence Griffith obtained each of the two spadices figured as *C. draco* in the *Palms Brit. Ind. pl. 201 A & B* is very doubtful. Griffith himself does not record the information on the sheets themselves, probably because *C. draco*, as understood by him, was widely distributed throughout the Malay Islands. But from the fact that Griffith adds to the particulars given under the habitat in Roxburgh's *Flora Indica** the following: "Penang, Mr. Lewes. *Jarnang* of the Malays of Penang", one would think that Penang was the place of origin of the spadices and that Lewis was their collector. But the words "Penang, Mr. Lewes" are deleted entirely in Griffith's second account, and instead "according to Mr. Lewis it is the" are inserted. This and the way Hooker has cited the specimens from Griffith's herbarium in the *Flora* suggests that only a part of them was collected by Lewis, while the other part was collected by Griffith himself or by his collector. Hooker however gives Penang as the place of origin for both these collections, while Ridley in the *Materials II* (*1907*) *182* gives Malacca and Penang.

In 1933 I had an opportunity to examine Griffith's herbarium in Kew, but as at the time the problem about the exact localities had not presented itself to me, I did not pay any special attention to search for any clues on the sheets that would help me to solve this question; but the notes I made at the time regarding the structure of the spadix and fruits state that the spadix mounted on the sheet No. 83 is the same as the one figured in the plate 201 B, but with all fruits fallen off. In the capsule mounted on this same sheet there are scales coverings and seeds of quite immature fruits mixed with some mature seeds. Obviously the scale coverings and younger seeds do not belong to the spadix which is represented in the above mentioned plate as having much larger and more mature fruits. The scale coverings are in a bad state of preservation, but still in three instances I was able to note that the scales were arranged in 13–15 orthostichies, a fact which suggests that the small fruits belong to *D. didymophyllus;* for this is the only dragon-blood-yielding *Daemonorops* in the Peninsula having its fruit scales arranged in so few series. But the latter is never known to produce so large and so diffuse a spadix as the one depicted by Griffith; in fact the spadix on the specimen in question and the fruits depicted by Griffith agree very well with the spadix and fruits figured by Beccari in the above quoted plate 44 of *D. propinquus*. But as this last (*D. propinquus*) produces fruits having scales

* The particulars recorded under the habitat in Roxburgh's *Flora Indica* run thus: "A native of Sumatra and the Malay Islands. Flowering time March and April."

arranged usually in 17–19 vertical series and never in less than 15, and that, unlike *D. didymophyllus*, it has not been found in Penang, one is inclined to suspect that the fruits on the sheet n. 83 had come from Mr. Lewis from Penang and that Griffith, or someone else, mounted them on the same sheet together with the other specimen collected by Griffith or his collector, apparently on the mistaken belief that they both belonged to one and the same species, if not to the same plant. Griffith himself had collected herbarium material in Malacca and later had maintained a collector there, and so it is not unlikely that the two specimens figured in the above quoted plates 201 A & B had come from Malacca. It is true also that *D. propinquus*, as interpreted here, is not represented in any other herbarium collections made in Malacca Settlement, but it has been found in the neighbouring state of Selangor.

Ridley in his *Flora* cited under *D. propinquus* a specimen collected by [Nur with] Foxworthy at Batu Papan on the banks of Sungei Keteh in Kelantan; but of the two *Daemonorops* from this collection labelled by Ridley as *D. propinquus* in the Kew herbarium, one is definitely *D. didymophyllus* and the other represents *D. brachystachys*. *D. propinquus* Becc. *sensu* Ridley in *Journ. Roy. Asiat. Soc. Str. Br. 33 (1900) 175* is *D. leptopus* Mart., at least for the greater part of the specimens quoted.

13. **Dæmonorops pseudomirabilis** Becc. **var. malayanus** Furtado **var. nov.**

*D. periacanthus* Miq. *sensu* Ridl. Mat. Fl. Malay. Pen. II (1907) 185 quoad specimen apud Chan Chu Kang lectum. **Syn. nov.**

*D. pseudomirabilis* Becc.? in Calc. Ann. XII (1911) 179, pl. 74. **syn. nov.**

*D. setigerus* Ridl. Fl. Mal. Pen. V (1925) 45 quoad specimen apud Chan Chu Kang lectum. **syn. nov.**

A forma typica differt folioli costis utrinque lævibus; spadicis pedunculo ad margines obtusas aculeis vel tuberculis spiniferis prædito; spiculis minoribus (6–7 cm. longis); fructus squamis concoloris, badio-gramineis.

Malay Peninsula: *Singapore*, loc. incert. (Ridley, 3515. Type in Singapore; and 3507, v.n. Rotan Chochor); Chan Chu Kang (Ridley 3493). *Johore*, Gunong Pulai (Goodall, in April 1921).

*D. pseudomirabilis* Becc. was based on a specimen derived from a plant cultivated in the Botanic Gardens, Buitenzorg, where it was said to have been introduced from

Palembang. A duplicate specimen of the type of the variety here described was doubtfully referred to the species by Beccari with the remarks that he was not sure of the plant as represented by the specimen being wild in Singapore. Though Ridley omitted any reference to this species in his *Flora V*, I think I am justified in deducing from the manner Ridley labelled his collections in the Singapore herbarium that both the above cited specimens bearing no definite locality on their labels were derived from wild plants. Besides there is the evidence of the Chan Chu Kang and the Gunong Pulai specimens that the variety is really wild in the Peninsula.

The leaflets in this variety are not arranged in very distinct groups and though the lowermost 6–7 leaflets are approximate into a distinct group with 3–4 divergent leaflets on each side of the rachis, the upper leaflets are porrect (not divergent) and irregularly scattered, occasionally two leaflets coming very close together. The total number of leaflets as counted in one leaf (Ridley's n. 3493) are 18–20 on each side of the rachis. The outermost spathe is cymbiform abruptly contracted at the apex and covered with deciduous acicular spines produced on transverse ridges or corrugations. At first sight the female spadix may be confused with that of *D. geniculatus*, but the involucrophores and involucres of the latter are hollow or cupuliform at the apex, whereas they are truncate with very little marginal rim in *D. pseudomirabilis* var. *malayanus*. In this respect the spikelets of the last mentioned resemble those of *D. longipes* in which, however, the fruits are much longer than broad, the leaflets more regularly arranged and the leaf-sheaths without any annular rings.

14. **Dæmonorops ruptilis** Becc. Calc. Ann. XII (1911) 211, t. 97.

*Daemonorops sp.* Merrill in Univ. Californ. Publ. Bot. XV (1929) 24.

BRITISH NORTH BORNEO: Tawao in Elphinstone Province (Elmer, 20484; 20825; and 21873).

Merrill makes the following remarks on these three specimens: "Not matched in Beccari Herbarium, nor can I refer it to any of the species figured by him; probably an undescribed species."

I have examined the duplicates bearing the above numbers in the Singapore herbarium and do not find any grounds to separate them from *D. ruptilis*, though Elmer's specimens represent a stage a little more devoloped than the type figured in the above-mentioned plate.

**15. Dæmonorops setigerus** Ridl. Fl. Malay. Pen. V (1925) 45.

In the *Materials II (1907) 185* Ridley had referred to *D. periacanthus* Miq. some specimens, giving one, at the same time, to understand that he was not wholly in agreement with Martius and Beccari regarding their interpretations of *D. geniculatus* and *D. verticillaris*. Beccari (*Calc. Ann. XII, 1911, pp. 169, 189 & 200*) pointed out that there were evidences to show that it was Ridley, rather than he and Martius, who was confused over the species and that *D. periacanthus* Miq. as interpreted by Ridley could not be Miquel's species, Ridley's species being of the group which bears decussating, membranous, spiniferous collars around the leaf-sheaths. But Ridley was not satisfied with Beccari's explanations and so in his *Flora* he not only adhered to his previous views regarding *D. geniculatus* and *D. verticillaris* but published a new binomial, *D. setigerus*, to include *D. periacanthus* Miq. *sensu* Ridley [*Materials II, (1907) 187*].

An inquiry into these three species has shown me that Beccari's views on *D. geniculatus* and *D. verticillaris* are correct and that *D. setigerus* Ridl. is an illegal binomial being a *mixtum compositum*. In spite of a definite statement by Griffith to the contrary, Ridley took *D. geniculatus* to be a species with an unarmed peduncle to the spadix, so that every specimen of *D. geniculatus* he saw with an armed peduncle (at times it is unarmed) is included by him under *D. setigerus*. Then he mistook female or neuter spadices of *D. verticillaris* for the male and on this belief he has transferred to *D. setigerus* most of the male specimens of *D. verticillaris* at his disposal and on this mixture he has based his description of *D. setigerus*. No doubt he has included in his citations a specimen which I have referred to *D. pseudomirabilis* var. *malayanus* (described above), but the specific description does not in any way apply to it. The specimens quoted by Ridley under *D. setigerus* are as follows (I have not been able to trace two specimens cited under *D. setigerus*. Probably they are at Kew) :—

(*a*) D. VERTICILLARIS (Griff.) Mart. *Malacca*, loc. incert. (Alvins, 1248, v.n. Rotan Gulang). *Pahang*, Kuala Lipis (Machado, 11632).

(*b*) D. GENICULATUS (Griff.) Mart. *Malacca*, Bukit Sandanan (Derry, 959 v.n. Rotan Kerai); Gunong Miring on Ophir (Ridley in 1892). *Perak*, Assam Kumbang (Wray, 1922); Taiping Hills (Ridley, 11409); Bujong Malacca (Ridley 9813). *Pahang*, Tahan River, (Mat. in Sept. 1893).

(*c*) D. PSEUDOMIRABILIS var. MALAYANUS Furtado. *Singapore,* Chan Chu Kang (Ridley, 3493).

In addition there are several specimens from Johore and Singapore which Ridley has determined as this species, though they belong to *D. Kunstleri* and *D. periacanthus;* but apparently they were not cited in his works. Among them is one collected by him on Mount Austen, where the Sungei Tebrau has its origin and this may be the Sungei Tebrau specimen quoted under *D. setigerus.* The specimen represents *D. Kunstleri.*

**16. Dæmonorops sparsiflorus** Becc. in Rec. Bot. Surv. Ind. II (1902) 224 et Calc. Ann. XII (1911) 126, pl. 102 quoad spiculas floriferentes.

BRITISH NORTH BORNEO: *Bole River,* alt. 700 feet (Keith, 4325); *Kinabalu Mountain Range:* Dallas alt. 2,000–3,000 feet (Clemens 26888; 27012; 27216); Paluan near Koung, alt. 1,500 feet (Carr 27377).

Keith's and Carr's specimens are male. Carr's specimen has spathes which are distinguished from the male of *D. sparsiflorus* var. *sarawakensis* Becc. by the fewer and much shorter, or rudimentary, bristles on the outside of their apex. The flowers in both the male specimens are somewhat spiral, or distichous in some parts and have a longer (up to 2 mm. long) distinctly pedicelliform involucrophore. The fruits in Clemens's specimens are very young, but they are sufficiently developed to show that the scales are arranged in 15 vertical rows. The involucrophore of the fruits is 5–7 mm. long, whereas in the *var. sarawakensis* it is only 3–4 mm. long even in fully developed fruits.

The species itself was based on a female specimen in flowers and owing to its apparent affinities to *D. draco,* Beccari had placed it among the *RESINIFERÆ,* and, though later Beccari described fruiting specimens of one of its varieties (*Calc. Ann. XII, 1911, p. 221*), he has not made any statement to show that the species and its variety are in fact non-resiniferous.

The species appears to be endemic in Borneo. No doubt the type of the species is Lobb's specimen said to have been collected in Labuan; but Lobb's specimens often bear incorrect localities.

**16-A. Var. sarawakensis** Becc. in Calc. Ann. XII (1911) 221 pl. 101 & 102.

BORNEO: Loc. incert. (Hewitt, v.n. Empunot); Kuching (Hewitt); Quop (Hewitt, n. P. 2, v.n. Rotan Landak); Gat near Upper Rejang River (Clemens 22089); Bau (Ridley 11824); Baram (Hewitt, n. R.E.).

In addition to its female flowers being distichously set, this variety, as pointed out above, differs from the type by the presence of many and much longer bristles at the apex of its primary spathes and by its shorter involucrophores in both the male and the female spadices. Apparently this form is more widely distributed than the type.

**17. Dæmonorops vagans** Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 469 et in Calc. Ann. XII (1911) 153, t. 62; Ridl. Fl. Malay Pen. V (1925) 43.

*D. periacanthus* Miq. *sensu* Ridley in Journ. F.M.S. Mus. IV (1909) 87. **syn. nov.**

MALAY PENINSULA: *Perak*, Maxwell's Hill (Burkill & Haniff, 12646; 12716; 13192 & 13196); Taiping Hills (Fox in 1899). *Pahang*, Sungei Lemoi (Jaamat 28190, v.n. *Rotan Kerei*); Telom Ridge (Ridley, 13915).

The only character that distinguishes this species in herbarium from *D. Kunstleri* is the gibbosity on the petiole. As to the fruit-scales, only Fox's specimen was noticed to have them exactly in 15 longitudinal series. Burkill & Haniff's 13192 has flowers only and so the number of vertical series in which the fruit-scales are arranged could not be ascertained. The fruits in Burkill & Haniff n. 13196 have the scales arranged in 15–17 series, while those of the other specimens have 18 series. The leaflets of this are usually narrower that in *D. Kunstleri*, but occasionally one comes across specimens of the latter species having similar, narrow leaflets. It has to be ascertained whether *D. vagans* represents only a form of *D. Kunstleri* at a very advanced age when, owing to the length of its stem, will have to depend more and more on the neighbouring trees for keeping itself erect. Such a condition may in the end contribute to the production of a gibbosity at the base of its petioles. Petioles with and without such gibbosity are described in *D. elongatus*.

I have not seen the Bornean specimen cited by Beccari (*l.c. 1911, p. 153*). Possibly it is a variety of *D. elongatus*.

## INDEX TO THE COLLECTORS' NUMBERS

ALVINS: 1248=XV–*a*.

BABJEE: 10168=X.

BECCARI: 3644=X.

BURKILL: 928=VI.

BURKILL & HANIFF: 12646=XVII; 12681=VI; 12716, 13192 & 13196=XVII; 13450=VI; 16792=XII.

BURN—MURDOCH: 13297=VII–*a*.

CARR: 27377—XVI.

CLEMENS: Sn.—IX; 22089=XVI–A; 26793 & 26807—IX; 26888 & 27012=XVI; 27156 & 27156*a*=IX; 27216=XVI; 27269—IX; 29193 & 29194=IV; 30887=IX; 31280 & 31280*a*=IX; 31581=IX; 40754; 50343 & 50547—IX.

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CURTIS: sn.=VII*c*; 2150=VII–*c*.

DERRY: 959=XV–*b*.

ELMER: 20482—VI; 20484 & 20825—XIV; 20840=IX obs; 21873—XIV.

FORBES: 2287—V in obs.

FOREST DEPART. COLL.—10209—X.

FOX: sn.=XVII.

GOODALL: sn.=XIII.

GOODENOUGH: 1667=VII–*c*.

GRIFFITH: sn. (?)—X & XII; 83=XII.

HAMID:=6380—X.

HANIFF: sn.=VII–*c*; 14231—VI; 15911=VII–A.

HANIFF & NUR: 7119=VII–A.

HENDERSON: 24532=VI.

HEWITT: sn.=I, VI & XVI–A; P2=XVI–A; RE=XVI–A.

HOLTTUM: 9257 & 10610—VII*b*; 10636—VIII obs; 10748—VII*b*; 10839=VII*a*; 10920=VIII; 21526—VII–*a*.

HUME: 8113=III.

JAAMAT: 28190—XVII.

JUNAS: 16403—VI.

KEITH: 4325—XVI.

LAMBAK: 10006—X.

LEWIS: sn.=XII obs.

MACHADO: 11632—XV-*a*.

MAT: sn.:VI, VII & XV-*b*.

MOORHOUSE: sn.=X.

NUR: 7308—V; 11671 & 11835=VII-*a*; 12076—III; 12113—VI; 20045—VI.

OMAR: 9916 & 9933—XII.

RIDLEY: sn.=VI, VII, VIII, X, XI. obs. & XV-*b*; 3476—VI; 3493—XIII & XV-*c*; 3507—XIII; 3515—XIII; 5875—VI; 6273 & 6277—VI; 6285 & 6672—VI; 7885—VI; 7905—VII-*b*; 9813—XV-*b*; 10343—VII-*b*; 10345 & 10437—VI; 10783—X obs; 10952—X; 11409—XV-*b*; 11823—VI; 11824=XVI-A; 12395—I; 12408—VI; 12409—I; 13451—VII-*a*; 13915—XVII; 15361—VII-*a*; 15884—VII-A; 16291—VII-*c*.

SAHIB: sn.=I.

SCORTECHINI: sn.=XII.

SHELFORD: sn.—I.

SMITH: 6701—X.

SYMINGTON: 24207—VI.

VAUGHAN-STEVENS: sn.—X.

WRAY: 1922—XV-*b*; 3658—III.



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